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AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH
INDEXES (SUPPLEMENT 361) (NASA) 56 p

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April 1992

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES



National Aeronautics and Space Administration
Scientific and Technical Information Program
Washington, DC

1992

INTRODUCTION

This issue of *Aerospace Medicine and Biology* (NASA SP-7011) lists 141 reports, articles and other documents originally announced in March 1992 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of *Aerospace Medicine and Biology* was published in July 1964.

Accession numbers cited in this issue are:

STAR (N-10000 Series)	N92-13926 — N92-15961
IAA (A-10000 Series)	A92-17255 — A92-20826

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the publication consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations include the original accession numbers from the respective announcement journals.

Seven indexes—subject, personal author, corporate source, foreign technology, contract, report number, and accession number—are included.

A cumulative index for 1992 will be published in early 1993.

Information on availability of documents listed, addresses of organizations, and NTIS price schedules are located at the back of this issue.

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TYPICAL REPORT CITATION AND ABSTRACT

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ACCESSION NUMBER → **N92-11637*** # Vanderbilt Univ., Nashville, TN. Dept. of Electrical Engineering. ← CORPORATE SOURCE

TITLE → **ROBOT GRAPHIC SIMULATION TESTBED Final Report**

AUTHORS → **GEORGE E. COOK, JANOS SZTIPANOVITS, CSABA BIEGL, GABOR KARSAL, and JAMES F. SPRINGFIELD** Aug. 1991 ← PUBLICATION DATE

CONTRACT NUMBER → (Contract NAG8-690) ← AVAILABILITY SOURCE

REPORT NUMBERS → (NASA-CR-188998; NAS 1.26:188998) Avail: NTIS HC/MF A06; 12 functional color pages CSCL 06/11 ← PRICE CODE COSATI CODE

The objective of this research was twofold. First, the basic capabilities of ROBOSIM (graphical simulation system) were improved and extended by taking advantage of advanced graphic workstation technology and artificial intelligence programming techniques. Second, the scope of the graphic simulation testbed was extended to include general problems of Space Station automation. Hardware support for 3-D graphics and high processing performance make high resolution solid modeling, collision detection, and simulation of structural dynamics computationally feasible. The Space Station is a complex system with many interacting subsystems. Design and testing of automation concepts demand modeling of the affected processes, their interactions, and that of the proposed control systems. The automation testbed was designed to facilitate studies in Space Station automation concepts.

Author

TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

ACCESSION NUMBER → **A92-10353**

TITLE → **EFFECTS OF HYPOXIA AND COLD ACCLIMATION ON THERMOREGULATION IN THE RAT**

AUTHORS → **H. GAUTIER, M. BONORA, S. B. M'BAREK, and J. D. SINCLAIR** (Paris VI, Universite, France; Auckland, University, New Zealand) ← AUTHORS' AFFILIATION

JOURNAL TITLE → **Journal of Applied Physiology (ISSN 0161-7567), vol. 71, Oct. 1991, p. 1355-1363. Research supported by Institut National de la Sante et de la Recherche Medicale. refs** ← PUBLICATION DATE

Copyright

Results are reported from an experimental study tracing the effects of hypoxia on thermoregulation and on the different sources of thermogenesis in rats before and after periods of 1-4 wk of cold acclimation. Measurements of the metabolic rate (VO₂) and body temperature (T_b) were made at 5-min intervals, and shivering activity was recorded continuously in groups of rats subjected to three protocols. Recordings were made in normoxia and in hypoxia on different days in the same animals. The results show that: (1) in noncold-acclimated (NCA) rats, cold exposure induced increases in VO₂ and shivering that were proportional to the decrease in T_a; (2) in cold-acclimated (CA) rats in normoxia, for a given ambient temperature, VO₂ and T_b were higher than in NCA rats, whereas shivering was generally lower; and (3) in both NCA and CA rats, hypoxia induced a transient decrease in shivering and a sustained decrease in nonshivering thermogenesis associated with a marked decrease in T_b that was about the same in NCA and CA rats. It is concluded that hypoxia acts on T_b control to produce a general inhibition of thermogenesis.

P.D.

LIFE SCIENCES (GENERAL)

A92-17287

**A MOLECULAR CHAPERONE FROM A THERMOPHILIC
ARCHAEBACTERIUM IS RELATED TO THE EUKARYOTIC
PROTEIN T-COMPLEX POLYPEPTIDE-1**

JONATHAN D. TRENT, ARTHUR L. HORWICH (Yale University, New Haven, CT), ELMAR NIMMESGERN, F.-U. HARTL (Sloan-Kettering Institute for Cancer Research, New York), and JOSEPH S. WALL (Brookhaven National Laboratory, Upton, NY) *Nature* (ISSN 0028-0836), vol. 354, Dec. 12, 1991, p. 490-493. Research supported by NIH, DOE, and DFG. refs
Copyright

A92-17939* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

FRACTAL DYNAMICS OF BIOCONVECTIVE PATTERNS

DAVID A. NOEVER (NASA, Marshall Space Flight Center, Huntsville, AL) *Physical Society of Japan, Journal* (ISSN 0031-9015), vol. 60, Oct. 1991, p. 3573-3578. refs
Copyright

Biologically generated cellular patterns, sometimes called bioconvective patterns, are found to cluster into aggregates which follow fractal growth dynamics akin to diffusion-limited aggregation (DLA) models. The pattern formed is self-similar with fractal dimension of 1.66 ± 0.038 . Bioconvective DLA branching results from thermal roughening which shifts the balance between ordering viscous forces and disordering cell motility and random diffusion. The phase diagram for pattern morphology includes DLA, boundary spokes, random clusters, and reverse clusters. Author

A92-18230

**SPATIAL COLOR VISION [PROSTRANSTVENNOE
TSVETOVOE ZRENIE]**

AL'GIS V. BERTULIS and VADIM D. GLEZER Leningrad, Izdatel'stvo Nauka, 1990, 145 p. In Russian. refs
Copyright

Results are presented from neurophysiological, psychophysiological, and model investigations of the principles of color vision in primates. The existence of two mechanisms of color vision in primates is postulated. One of these mechanisms, which involves simple and complex cells of the visual cortex, is responsible for the perception of the spatial distribution of spectral energy of the image. The second mechanism, which involves cells located in the striated cortex, is responsible for the perception of the object's color. Both mechanisms receive the same subcortical input and act as parallel systems. I.S.

A92-18241

**OPTIMIZATION OF ADAPTATION PROCESSES IN AN
ORGANISM [OPTIMIZATSIYA ADAPTIVNYKH PROTSESOV
ORGANIZMA]**

ELIZAR IA. KAPLAN, OKTIABRINA D. TSYRENZHAPOVA, and

LARISA N. SHANTANOVA Moscow, Izdatel'stvo Nauka, 1990, 96 p. In Russian. refs
Copyright

The mechanisms involved in adaptation of an organism to hostile environments and in regulation of adaptation processes are discussed, with particular attention given to the possible mechanism of the action of Cardecaim, a Tibetan multicomponent plant extract which exhibits a wide spectrum of adaptogenic activity. Consideration is also given to the role of the liver in adaptation and the effect of hepatoprotective plant preparations on adaptation. Experimental data are presented showing that the use of liver-protecting preparations in combination with adaptogens increases the level of the nonspecific resistance of the organism. I.S.

A92-18242

**NEUROMEDIATORY MECHANISMS OF ADAPTATION
[NEIROMEDIATORNYE MEKHANIZMY ADAPTATSII]**

SEVAST'IAN KH. KHAIDARLIU Kishinev, Izdatel'stvo Shtiintsa, 1989, 180 p. In Russian. refs
Copyright

The role of neurotransmitters in the activation of both specific and nonspecific adaptation mechanisms is discussed. The principles of interaction between individual neurotransmitter systems are formulated. It is shown that the reactions of an organism to stress are optimized by an interaction of a specific neurotransmitter system with the stress hormone. The feasibility of increasing the adaptation capacity of an organism by improving the functioning of neurotransmitter systems is discussed. I.S.

A92-18312

**ADAPTATION OF THE ORGANISM TO STRESS AND TO
HIGH-ALTITUDE HYPOXIA LEADS TO THE ACCUMULATION
OF DIFFERENT HSP 70 ISOFORMS IN THE RAT
MYOCARDIUM [ADAPTATSIIA ORGANIZMA K STRESSU I K
VYSOTNOI GIPOKSII PRIVODIT K NAKOPLENIIU V
MIOKARDE KRYIS RAZNYKH IZOFORM HSP 70]**

A. V. ZAMOTRINSKII, I. IU. MALYSHEV, and F. Z. MEERSON (AMN SSSR, NII Obshchei Patologii i Patologicheskoi Fiziologii, Moscow, USSR). *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), vol. 320, no. 2, 1991, p. 470-472. In Russian. refs
Copyright

A92-18318

**NEURON ACTIVITY OF THE MONKEY NEOSTRIATUM UNDER
CONDITIONS OF COMPLEX OPERATOR ACTIVITY
[NEIRONNAIA AKTIVNOST' NEOSTRIATUMA OBEZ'IAN V
USLOVIIAKH SLOZHNOI OPERATORSKOI DEIATEL'NOSTI]**

A. A. ORLOV, B. P. MOCHENKOV, and B. F. TOLKUNOV (AN SSSR, Institut Evoliutsionnoi Fiziologii i Biokhimii, Leningrad, USSR). *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), vol. 320, no. 3, 1991, p. 757-760. In Russian. refs
Copyright

A92-18539

**C.E.B.A.S.-AQUARACK - THE 'SECOND GENERATION
HARDWARE' AND SELECTED RESULTS OF THE SCIENTIFIC
FRAME PROGRAM**

V. BLUEM, E. STREZKE (Bochum, Ruhr-Universitaet, Federal Republic of Germany), and K. KREUZBERG (DLR, Cologne,

Federal Republic of Germany) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 10 p. Research supported by BMFT and Ministerium fuer Wissenschaft und Forschung des Landes Nordrhein-Westfalen. refs
(IAF PAPER 91-537) Copyright

The 'Closed Equilibrated Biological Aquatic System' (C.E.B.A.S.) is a long-term multigeneration experimental system for aquatic organisms which represents a German option for the Columbus Space Station and which was further developed to fit into the device of a so-called AQUARACK. The paper presents the current status of the hardware development of the second laboratory prototype and shows some selected examples of the scientific frame program. In this context, special attention is paid to the predominant subproject of the reproductive biology of *X. helleri* where results of investigations are presented on all three levels of the brain-pituitary-gonadal axis. Moreover, the possible role of the project in the development of a combined aquaculture system for utilization in a lunar or planetary base is discussed. Author

A92-18540

BIOLABOR, FACILITIES FOR BIOLOGICAL AND BIOPROCESSING EXPERIMENTS ON GERMAN SPACELAB MISSION D-2

K. KREUZBERG, G. HEY, A. SALTZMANN, V. SOBICK (DLR, Cologne, Federal Republic of Germany), U. FRIEDRICH, H. U. HOFFMANN (Deutsche Agentur fuer Raumfahrtangelegenheiten GmbH, Bonn, Federal Republic of Germany), S. WALTHER (MBB-ERNO, Bremen, Federal Republic of Germany), V. STROBEL (Dornier GmbH, Friedrichshafen, Federal Republic of Germany), and P. JUNK (OHB System GmbH, Bremen, Federal Republic of Germany) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 8 p. refs
(IAF PAPER 91-538) Copyright

A double rack for spacelab scientific testing is presented with descriptions of its features and scientific capabilities with reference to the German D-2 mission. The Biolabor double rack is intended to support four incubators, an electrocell-fusion bench, a threshold centrifuge, two coolers, a box to maintain a constant 37 C, and additional scientific hardware. The hardware is specific to experiments with animal larvae and cell cultures and includes a turbidimeter and a dialysis chamber. The rack elements can be used for thermally conditioned processing of biological samples, electrofusion experiments, testing specimen sensitivity to gravity, and the spatial orientations of animals and single cells. The Biolabor rack can facilitate testing in the broad areas of gravitational biology, cell biology, and bioprocessing. C.C.S.

A92-18542

PLANETARY QUARANTINE IN THE SOLAR SYSTEM - SURVIVAL RATES OF SOME TERRESTRIAL ORGANISMS UNDER SIMULATED SPACE CONDITION BY PROTON IRRADIATION

J. KOIKE and T. OSHIMA (Tokyo Institute of Technology, Yokohama, Japan) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 9 p. Research supported by MOESC. refs
(IAF PAPER 91-542) Copyright

The survival rates of some species of terrestrial unicellular and multicellular organism (viruses, bacteria, yeasts, fungi, and algae) were studied under simulated interstellar conditions in connection with planetary quarantine. The interstellar environment in the solar system has been simulated by low temperature, high vacuum (77 K, 4×10^{-8} torr), and proton irradiation from a Van de Graaff generator. After exposure to a barrage of protons corresponding to about 250 years of irradiation in solar space, Tobacco mosaic virus, *Bacillus subtilis* spores, *Staphylococcus aureus*, *Micrococcus flavus*, *Aspergillus niger* spores, and *Clostridium manganoti* spores showed survival rates of 82, 45, 74, 13, 28, and 25 percent, respectively. Author

A92-18564

DEVELOPMENT OF BIOLOGICAL LIFE SUPPORT SYSTEMS

R. KLINTWORTH, J. WARRELMANN, and S. WALTHER

(MBB-ERNO, Bremen, Federal Republic of Germany) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 6 p.

(IAF PAPER 91-574) Copyright

Life support systems for studying botanical and zoological objects are being developed by inhouse activities of MBB/ERNO. Scientific research on behavior or response of a versatile range of biological samples will now be accessible for experimenters through employing very cost-efficient multiuser facilities. Both Biomaus and Aquazelle are designed modular with respect to their core component composition and flight options. Author

A92-18567*

National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

THE BIOLOGICAL FLIGHT RESEARCH FACILITY

CATHERINE C. JOHNSON (NASA, Ames Research Center, Moffett Field, CA) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 8 p. refs
(IAF PAPER 91-578) Copyright

NASA Ames Research Center is building a research facility, the Biological Flight Research Facility (BFRF), to meet the needs of life scientists to study the long-term effects of variable gravity on living systems. The facility will be housed on Space Station Freedom and is anticipated to operate for the lifetime of the station, approximately 30 years. It will allow plant and animal biologists to study the role of gravity, or its absence, at varying gravity intensities for varying periods of time, and with various organisms. The principal difference between current Spacelab missions and those on Space Station Freedom, other than length of mission, will be the capability to perform on-orbit science procedures and the capability to simulate earth gravity. Initially, the facility will house plants and rodents in habitats which can be maintained at microgravity or can be placed on a 2.5-m diam centrifuge. However, the facility is also being designed to accommodate future habitats for small primates, avian, and aquatic specimens. The centrifuge will provide 1 g for controls and will also be able to provide gravity from 0.01 to 2.0 g for threshold gravity studies as well as hypergravity studies. The BFRF will provide the means to conduct basic experiments to gain an understanding of the effects of microgravity on the structure and function of plants and animals, as well as investigate the role of gravity as a potential countermeasure for the physiological changes observed in microgravity. Author

A92-18598

WHOLE BODY AND MUSCLE RESPIRATORY CAPACITY WITH DOBUTAMINE AND HINDLIMB SUSPENSION

D. DESPLANCHES, R. FAVIER, B. SEMPORÉ, and H. HOPPELER (Lyon I, Université, France; Bern, Universitaet, Switzerland) Journal of Applied Physiology (ISSN 0161-7567), vol. 71, Dec. 1991, p. 2419-2424. Research supported by Fondation pour la Recherche Medicale Francaise and Association Claude Bernard. refs
Copyright

The hypothesis that a long-term sympathoadrenal stimulation could counteract some or all of the detrimental consequences of muscle unweighting has been tested. In particular, the study was aimed at determining the effect of dobutamine on a whole body maximal oxygen uptake and on the ultrastructural composition and capillarity of the soleus muscle exposed to 5 wk of hindlimb unweighting. Results obtained suggest that (1) dobutamine is useful for preventing the decrease of total aerobic capacity during hindlimb suspension, (2) dobutamine increases maximal oxygen uptake in control rats, and (3) total capillary length in soleus muscle is increased by the drug, although no beneficial effects on mitochondria can be detected. O.G.

A92-18599

RELATIVE CONTRIBUTION OF GRAVITY TO PULMONARY PERFUSION HETEROGENEITY

ROBB W. GLENNY, LINCOLN POLISSAR, and H. T. ROBERTSON (Washington, University, Seattle) Journal of Applied Physiology (ISSN 0161-7567), vol. 71, Dec. 1991, p. 2449-2452. Research supported by American Heart Association. refs

(Contract NIH-HL-24163)

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An analytic approach to determine the relative contribution of gravity to pulmonary perfusion heterogeneity is presented. The approach, based on an analysis of variance, makes it possible to quantitatively compare the effects of gravity and lung structure as determinants of pulmonary perfusion heterogeneity. Regional pulmonary perfusion was measured in five anesthetized and ventilated dogs in both supine and prone positions by use of radiolabeled microspheres injected during apnea at functional residual capacity. It is concluded that, in supine and prone dogs, gravity plays a minor role in determining weight-normalized perfusion heterogeneity. It is suggested that the structure of the vascular tree is the principal determinant of flow heterogeneity.

O.G.

A92-19848

THE ANTIQUITY OF OXYGENIC PHOTOSYNTHESIS - EVIDENCE FROM STROMATOLITES IN SULPHATE-DEFICIENT ARCHAEN LAKES

ROGER BUICK (Harvard University, Cambridge, MA) Science (ISSN 0036-8075), vol. 255, Jan. 3, 1992, p. 74-77. refs (Contract NSF BSR-85-16328; NSF BSR-88-17662)

Copyright

The Tumbiana Formation, about 2700 million years old, was largely deposited in ephemeral saline lakes, as judged by the unusual evaporite paragenesis of carbonate and halite with no sulfate. Stromatolites of diverse morphology occur in the lacustrine sediments, some with palimpsest fabrics after erect filaments. These stromatolites were probably accreted by phototropic microbes that, from their habitat in shallow isolated basins with negligible sulfate concentrations, almost certainly metabolized by oxygenic photosynthesis.

Author

A92-20468

MEASUREMENT OF CIRCUMNUTATION IN MAIZE ROOTS

KARL H. HASENSTEIN (Southwestern Louisiana, University, Lafayette, LA) Microgravity Science and Technology (ISSN 0938-0108), vol. 4, Dec. 1991, p. 262-266. refs

Copyright

A technique is presented which facilitates the measurement of growth, spatial movement, and angular orientation of root tips at high resolution. Two perpendicularly mounted video cameras are used in a computer-driven video-digitizer system to study the growth of primary maize roots in real time. The growth rate, straight growth, and tip orientation of the roots fluctuate, and the movement of the roots is less uniform than that of the circumnutational shoot activity. The results are interpreted as evidence of internal growth regulation that leads to the endogenous movements, and the roots appear to exhibit some sensitivity or adaptive qualities inherent in the growing tissues. The results are of interest to understanding the irregular growth of such plants under microgravity because the endogenous movements appear to contribute to the gravitropic response.

C.C.S.

A92-20469

CLINOSTATIC ROTATION DECREASES CROSSOVER FREQUENCIES IN THE FUNGUS SORDARIA MACROSPORA AUERSW

J. HENKEL (Max-Planck-Institut fuer Biochemie, Martinsried, Federal Republic of Germany) and B. HOCK (Muenchen, Technische Universitaet, Munich, Federal Republic of Germany) Microgravity Science and Technology (ISSN 0938-0108), vol. 4, Dec. 1991, p. 267-272. refs

Copyright

Two-factor crosses between the nonallelic spore-color mutants *r2* and *lu* of the fungus *Sordaria macrospora* were used to investigate the effect of clinostatic rotation (= simulated weightlessness) on crossover frequencies. The experiment was carried out with different rotary directions at a rotary rate of 4 rpm. Second-division segregations of the gene *lu*, which result from crossover between the gene locus and centromere, are significantly smaller in the clinostat experiments than in the static

controls. No differences were found between the two rotary directions. A similar influence of clinostatic rotation was not observed for the gene *r2* which in contrast to the *lu* locus is located very close to the centromere. The suitability of this approach for the investigation of the effect of space flight conditions on cytogenetic processes is pointed out.

Author

A92-20715

LACK OF EFFECT OF GALLIUM NITRATE ON BONE DENSITY IN A RAT MODEL OF SIMULATED MICROGRAVITY

GLEN APSELOFF, NICHOLAS GERBER, DALE R. SHEPARD, VELIMIR MATKOVIC (Ohio State University, Columbus), and BEVERLY GIRTEN (Wright State University, Dayton, OH) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, Jan. 1992, p. 27-31. refs

Copyright

Microgravity conditions are simulated for 24 rats to determine the effect of Ga nitrate on bone density during and after 14 d of tail suspension. The four groups studied include suspended and unsuspended rats being treated with saline solution or the Ga nitrate. One day before the suspension began the subjects received an injection of either the saline or Ga solutions, and the limbs are analyzed in vitro with single-photon absorptiometry. The results suggest that Ga does not prevent bone loss in the tail-suspended rats. The results are considered in the light of previous investigations that demonstrated the propensity of Ga to inhibit bone resorption in humans with Paget's disease, and others that linked the functional similarities of Ga and diphosphonates in preventing bone loss.

C.C.S.

N92-14477# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Biochemistry.

THE BIOTECHNOLOGY OF CULTIVATING DUNALIELLA RICH IN BETA CAROTENE: FROM BASIC RESEARCH TO INDUSTRIAL PRODUCTION

MORDHAY AVRON *In* NAS-NRC, Potential Applications of Concentrated Solar Energy p 138-139 1991
Avail: NTIS HC/MF A08

The unicellular alga *Dunaliella* exists in several ill-defined species. In hypersaline lakes, the *Dunaliella* strain which predominates is often red, rather than green, in color, due to massive accumulation of a single pigment, beta-carotene. Of the many strains of the genus *Dunaliella* described, only two strains, *Dunaliella bardawil* and *Dunaliella salina* Teod., have been shown to possess the capacity to produce large amounts of beta-carotene, when cultivated under appropriate conditions. Intensive cultivation of *Dunaliella* may be the first commercially successful example of the use of selected algae for the biological conversion of solar energy into products of commercial interest. This approach has so far been hampered by the economic difficulties inherent in the production of a sophisticated technology. The high-priced product, beta-carotene, accounts for the renewed interest in algal cultivation. After extraction of the beta-carotene from the concentrated *Dunaliella*, there remains a glycerol and protein-rich algae meal, which was shown to serve as an excellent source of feed for fish, fowl, and rats. Thus, we have in the *Dunaliella* cultivation system the aquaculturist's and ecologist's ideal facility: a production unit which removes CO₂ from the air; produces oxygen, useful chemical products, and feed; and leaves no polluting residue requiring disposal.

Author

N92-14478# Midwest Research Inst., Golden, CO. Biotechnology Research Branch.

PRODUCTION POTENTIAL OF BIOCHEMICALS FROM ALGAE AND OTHER BIOTECHNOLOGICAL INNOVATIONS ENABLED BY HIGHER SOLAR CONCENTRATION

LEWIS M. BROWN *In* NAS-NRC, Potential Applications of Concentrated Solar Energy p 140 1991
Avail: NTIS HC/MF A08

The approach of using multiple-sun light intensity to increase the yield of various products from autotrophically grown algae is relatively unexplored. There are some possibilities for advanced photobioreactor design that might result in increased culture density

and hence lower culture volume. However, culture productivity and product yield do not increase linearly with light intensity, but rather saturate a fairly low light intensities for most algae in the range of 15-20 percent of full sun depending on species and on growth irradiance. Instantaneous measurements of photosynthesis indicate that algae grown under higher light intensities are saturated at higher photosynthetic rates than algae grown under lower light intensities. There is no obvious advantage to growing algae at full sun let alone multiple suns because no increase in productivity is typically realized. However, it may be possible to grow algae in more concentrated culture at multiple-sun irradiances if smaller culture volumes are desired. Other aspects of this research are discussed.

Author

N92-14577# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

22 Oct. 1991 54 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-91-019) Avail: NTIS HC/MF A04

Abstracts of Soviet publications in various areas of the life sciences are presented. The areas covered include: biochemistry, biophysics, pharmacology, toxicology, and virology. K.S.

N92-14578# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

28 Oct. 1991 65 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-91-020) Avail: NTIS HC/MF A04

Translations are presented from several Russian technical publications. They are divided under several general topics, including the following: agricultural science; biochemistry; biophysics; epidemiology; genetics; immunology; laser bioeffects; medicine; microbiology; molecular biology; pharmacology; toxicology; physiology; public health; radiation biology; and virology. E.R.

N92-14579# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

13 Nov. 1991 31 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-91-021) Avail: NTIS HC/MF A03

Translations are presented of articles from several Russian publications. They are headed under several general topics including the following: agricultural science; biochemistry; biotechnology; genetics; medicine; microbiology; pharmacology; toxicology; physiology; and virology. E.R.

N92-14580# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

19 Nov. 1991 49 p Transl. into ENGLISH of various Russian articles

(JPRS-ULS-91-022) Avail: NTIS HC/MF A03

Abstracts of Soviet publications in various areas of the life sciences are presented. The areas covered include: military medicine and public health. K.S.

N92-14581# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

26 Nov. 1991 62 p Transl. into ENGLISH of various Russian articles

(JPRS-ULS-91-023) Avail: NTIS HC/MF A04

Abstracts of Soviet publications in various areas of the life sciences are presented. The areas covered include: aerospace medicine, epidemiology, and public health. K.S.

N92-14582# Joint Publications Research Service, Arlington, VA.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

29 Nov. 1991 47 p Transl. into ENGLISH of various Russian articles

(JPRS-ULS-91-024) Avail: NTIS HC/MF A03

Abstracts of Soviet publications in various areas of the life sciences are presented. The areas covered include: laser bioeffects, medicine, microbiology, and radiation biology. K.S.

N92-14583# California Univ., Berkeley. Lawrence Berkeley Lab.

ELECTROMAGNETIC FIELD EFFECTS ON CELLS OF THE IMMUNE SYSTEM: THE ROLE OF CALCIUM SIGNALLING

J. WALLECZEK Jul. 1991 45 p Presented at the 75th Annual Meeting of the Federation of American Societies for Experimental Biology (FASEB), Atlanta, GA, 21-25 Apr. 1991 (Contract DE-AC03-76SF-00098)

(DE92-000852; LBL-31097; CONF-9104107-1) Avail: NTIS HC/MF A03

During the past decade considerable evidence has accumulated demonstrating the exposures of cells of the immune system to relatively weak extremely low frequency (ELF) electromagnetic fields (less than 300 Hz) can elicit cellular changes which might be relevant to in-vivo immune activity. However, knowledge about the underlying biological mechanisms by which weak fields induce cellular changes is still very limited. It is generally believed that the cell membrane and Ca^{2+} regulated activity is involved in bioactive ELF field-coupling to living systems. This article begins with a short review of the current state of knowledge concerning the effects of nonthermal levels of ELF electromagnetic fields on the biochemistry and activity of immune cells, and then closely examines new results which suggest a role for Ca^{2+} in the induction of these cellular field effects. Based on these findings it is proposed that membrane-mediated Ca^{2+} signalling processes are involved in the mediation of field effects on the immune system. DOE

N92-15522# International Centre for Theoretical Physics, Trieste (Italy).

ON CORRELATIONS OF NEURONAL SPIKE DISCHARGES

S. I. DOGUWA Oct. 1990 19 p

(DE91-625187; IC-90/292) Avail: NTIS HC/MF A03

To assess the dependence structure in two simultaneously occurring stationary spike trains A and B, the cross intensity function, $C_{\text{sub } f}(t)$ and the pair correlation function $g(t)$ can be very useful. Doss (1989) provides an estimate of $C_{\text{sub } f}(t)$ at a finite number of points. However, this estimator does not take into consideration the bounded nature of the sampling interval (beta). Two new boundary corrected estimators are proposed. These two estimators have a much smaller bias and mean squared error than the existing alternative. The spike discharges recorded simultaneously from a pair of auditory nerve fibers are analyzed using the new estimators. DOE

N92-15523# International Centre for Theoretical Physics, Trieste (Italy).

FLUCTUATION IN TISSUE TEMPERATURE DUE TO ENVIRONMENTAL VARIATION. PART 1: EFFECT OF FREE CONVECTION CURRENTS

A. R. BESTMAN Dec. 1990 11 p

(DE91-641475; IC-90/470) Avail: NTIS HC/MF A03

Naturally when there is heat transfer between the environment and a vertical tissue, free convection currents arise and these currents provoke fluid motion. This problem is solved in this paper for the transient situation when there is a step change in the environmental temperature for the idealized situation of a single tissue. The Laplace transform technique does not allow an analytic inversion. However, for limiting values of the film heat transfer coefficient, analytical solutions are obtained. This work compliments previous ones where tissue is assumed horizontal and free convection currents are ignored. DOE

N92-15524# International Centre for Theoretical Physics, Trieste (Italy).

FLUCTUATION IN TISSUE TEMPERATURE DUE TO ENVIRONMENTAL VARIATION. PART 2: EFFECT OF BODY THERMAL RADIATION

A. R. BESTMAN Dec. 1990 7 p
(DE91-641476; IC-90/471) Avail: NTIS HC/MF A02

When the body temperature is very high, there is the need to incorporate thermal radiation in the bioheat equation. This problem is modelled and solved when there is a small step rise in the environmental temperature. Employing the Laplace transform and the WKB approximation asymptotic solutions are obtained for limiting values of the skin film coefficients. These analytical solutions are discussed quantitatively. DOE

N92-15525# International Centre for Theoretical Physics, Trieste (Italy).

FLUCTUATION IN TISSUE TEMPERATURE DUE TO ENVIRONMENTAL VARIATION. PART 3: EFFECT OF EXTERNAL THERMAL RADIATION

A. R. BESTMAN Dec. 1990 8 p
(DE91-641477; IC-90/472) Avail: NTIS HC/MF A02

In this paper thermal radiative heat transfer is considered when there is heat exchange between very hot environment and the skin. The Laplace transform method coupled with limiting values of the film heat transfer coefficients yield analytical solutions for the perturbed temperature equations. The analytical results are discussed. DOE

N92-15526# California Univ., Berkeley. Lawrence Berkeley Lab.

LIFE SCIENCES

L. DAY, ed. Apr. 1991 95 p
(Contract DE-AC03-76SF-00098)
(DE92-000642; LBL-30557) Avail: NTIS HC/MF A05

This document is the 1989-1990 Annual Report for the Life Sciences Divisions of the University of California/Lawrence Berkeley Laboratory. Specific progress reports are included for the Cell and Molecular Biology Division, the Research Medicine and Radiation Biophysics Division (including the Advanced Light Source Life Sciences Center), and the Chemical Biodynamics Division. DOE

N92-15527# Trinity Univ., San Antonio, TX. Radiation Bioeffects Center.

DEFINITION OF PROCEDURES FOR CHRONIC EXPOSURE OF CANCER-PRONE MICE TO LOW-LEVEL 2,450-MHZ RADIO-FREQUENCY RADIATION Final Report, Jan. - Apr. 1991

MELVIN R. FREI and JAMES H. MERRITT Sep. 1991 21 p
(Contract F33615-87-D-0627)
(AD-A242438; AL-TR-1991-0077) Avail: NTIS HC/MF A03
CSCL 06/5

Several published reports have implied that long-term, low-level exposure to radio-frequency radiation (RFR) may influence the growth and/or differentiation of mammalian cells in vivo. Specifically, the issue involves whether or not such RFR exposure can cause cells to differentiate into an invasive form (tumor induction) or can act as a promoter of tumor expression. To address this issue, the United States Air Force sponsors a project involving long-term exposure of tumor-prone mice to low-level 435-MHz RFR. An earlier onset, greater incidence, or faster growth rate of tumors in the irradiated group, as compared to sham irradiated controls, would suggest an enhanced tumor promotion potential. This investigation is essentially a parallel study to that being conducted at 435 MHz. The critical difference is the exposure frequency; this study will be conducted at 2,450 MHz, which is near the resonant frequency for mice. Knowledge gained from this study will contribute to the ongoing evaluation of safety standards for human exposure to RFR which is essential to the protection of military operational personnel and the general public. GRA

N92-15528# Texas Univ., San Antonio. Div. of Life Sciences.

EFFECTS OF MICROWAVE RADIATION ON NEURONAL ACTIVITY Final Report, 1 Sep. 1989 - 31 Jan. 1991

DEBORAH L. ARMSTRONG, JOHN B. DENNY, PATRICK NASH, and SVETA SINGH Oct. 1991 18 p
(Contract F33615-87-D-0626; AF PROJ. 2312)
(AD-A242515; AL-TR-1991-0069) Avail: NTIS HC/MF A03
CSCL 20/5

A microwave radiation device was designed and constructed for exposure of fetal rat neurons during microscopic observation. The device exposed growing neurons to 400 MHz radiation amplitude modulated at 16 Hz. Continuous exposure to radio-frequency radiation for 4 consecutive days led to the development of cell number density gradient. The greater number of cells occurred in the center of the culture plate which was directly in the field as opposed to the more peripheral areas of the plate which were outside of the field. Nonirradiated control cultures did not display this gradient. This finding was replicated under various exposure periods. The gradient was formed within 20 min of placing the plates on the antenna. GRA

N92-15529# Texas Univ., El Paso.

THE EFFECTS OF PRALIDOXIME, ATROPINE, AND PYRIDOSTIGMINE ON THERMOREGULATION AND WORK TOLERANCE IN THE PATAS MONKEY Final Report, Jan. 1989 - Dec. 1990

REYNALDO S. ELIZONDO Oct. 1991 20 p
(Contract F33615-87-D-0627)
(AD-A242556; AL-TR-1991-0067) Avail: NTIS HC/MF A03
CSCL 06/5

A continuous flow indirect calorimetry system was used to continuously measure metabolic rates in patas monkeys at rest or during exercise when exposed to ambient temperatures of 25 or 35 C. The exercise system was also used to evaluate the effects of pralidoxime, atropine, and/or pyridostigmine on the exercise tolerance time in primates. Rectal temperature and heart rate were continuously monitored by a telemetry system while total evaporative water loss was estimated from weight differences before and after exercise. Resting metabolic rates measured at 35 C were significantly higher than at 25 C and averaged 73.3 and 49.1 W/m² respectively. No significant difference was observed in the exercising metabolic rates of the patas monkey measured at 25 C which averaged 126.3 and that at 35 C which averaged 123.4 W/m². No significant drug effects on metabolic rate or respiratory quotient were observed. Pyridostigmine treatment was associated with an increase in exercise time, a lower rectal temperature, heart rate, and a 40 percent increase in water loss. Atropine treatment produced a decrease in exercise time of 61 min and water loss, and an increase in heart rate. Pralidoxime treatment alone or in combination with atropine had no significant effect on exercise time or thermoregulation. Pyridostigmine treatment in combination with atropine resulted in a significant increase in exercise time and a 47 percent increase in water loss when compared to atropine treatment alone. GRA

N92-15530# Trinity Univ., San Antonio, TX.

LATE IMMUNOBIOLOGICAL EFFECTS OF SPACE RADIATION Final Report, Feb. - Dec. 1989

WILLIAM H. STONE and MICHAEL L. MILLER Dec. 1990 29 p
(Contract F33615-87-D-0626)
(AD-A242590; USAFSAM-TR-90-39) Avail: NTIS HC/MF A03
CSCL 06/5

The objective of this investigation was to obtain profiles of immune competence in primates more than 25 years following exposures to protons. The availability of irradiated animals provided a unique opportunity to study immune defects which could be relevant to astronauts and high flying pilots. The Delayed Radiation Effects Colony at Brooks Air Force Base provided blood samples. Antibody mediated immune function (associated with B-cell function) was assessed by measuring immunoglobulin levels, hemolytic complement activity and autoantibodies; cell mediated immune function (associated with T-cell function) was evaluated

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by measuring selected T and B cell activity plus response to mitogens and interleukin production. There were no significant differences between control and irradiated animals for most parameters measured in this preliminary survey, but lymphocyte proliferation tended to decrease as radiation dosage increased. Survivors of low and intermediate doses of proton irradiation apparently show few late immunobiological effects, which is encouraging. Additional monkeys will be measured in future confirmatory studies. GRA

N92-15531# California Univ., Santa Barbara. Marine Science Inst.

THE GENETIC BASIS OF SPECIFICITY IN DINOFLAGELLATE-INVERTEBRATE SYMBIOSIS Final Report, 1 Jul. 1988 - 30 Sep. 1991

ROBERT K. TRENCH 30 Sep. 1991 4 p

(Contract N00014-88-K-0463)

(AD-A242631) Avail: NTIS HC/MF A01 CSCL 06/1

The prime goals of this award were: (1) to study the composition of the cell walls of symbiotic dinoflagellates; (2) analyze the chemical composition of the glycoproteins exuded by symbiotic dinoflagellates; and (3) sequence the SSU rRNA gene from the symbiotic dinoflagellate *Symbiodinium pilosum* and assess its phylogenetic position relative to other protists. All three of these goals have been accomplished, and manuscripts or published papers describing the observations are attached. Briefly, the cell walls of symbiotic dino-flagellates are composed of cellulose and proteins, but whether any of the proteins are involved in recognition of symbionts by hosts remains unresolved. The large molecular weight glycoproteins exuded by symbiotic dinoflagellates have been characterized, and polyclonal antibodies have been prepared against them. We have preliminary evidence that show that the glycoproteins exuded by the symbionts in culture are also exuded in hospite. Analyses of the SSU rRNA sequence of *S. pilosum* shows that it is clustered among the dinoflagellates which appear to share a common ancestry with the Apicomplexa and the Ciliata. GRA

N92-15532# California Univ., Santa Barbara. Marine Science Inst.

MOLECULAR MECHANISMS OF CHEMOSENSORY RECEPTORS, SIGNAL TRANSDUCERS, AND THE ACTIVATION OF GENE EXPRESSION CONTROLLING ESTABLISHMENT OF A MARINE SYMBIOSIS Final Technical Report, 1 Aug. 1987 - 31 Oct. 1990

DANIEL E. MORSE 31 Oct. 1990 6 p

(Contract N00014-87-K-0762)

(AD-A242729) Avail: NTIS HC/MF A02 CSCL 06/1

The objectives of this research were (1) to characterize the molecular mechanisms by which marine invertebrate larval chemosensory receptors and their associated signal transducers regulate surface attachment and metamorphosis of the larvae in response to chemical signals from the environment; and (2) to characterize the molecular mechanisms regulating the activation of specific gene expression in the developmentally arrested marine invertebrate larva, in response to chemical inducers of metamorphosis. We have found that metamorphosis in larvae of the marine mollusc, *Haliotis rufescens* (red abalone), is controlled by exogenous chemical signals recognized and transduced by two convergent chemosensory pathways: a morphogenetic pathway activated by a GABA mimetic peptide morphogen encountered by the larvae on surfaces of recruiting (host) algae, and a regulatory pathway stimulated by lysine in seawater. The system displays both habituation, acting at the level of the morphogenetic pathway receptors and facilitation, mediated by the regulatory pathway. Output and sensitivity of the morphogenetic pathway are amplified as much as 100-fold by stimulation of the regulatory pathway. GRA

N92-15533*# Research Triangle Inst., Research Triangle Park, NC.

ENGINEERING DERIVATIVES FROM BIOLOGICAL SYSTEMS FOR ADVANCED AEROSPACE APPLICATIONS

DANIEL L. WINFIELD, DEAN H. HERING, and DAVID COLE Dec. 1991 288 p Original contains color illustrations (Contract NAS2-13119)

(NASA-CR-177594; A-92016; NAS 1.26:177594) Avail: NTIS HC/MF A13; 6 functional color pages CSCL 06/3

The present study consisted of a literature survey, a survey of researchers, and a workshop on bionics. These tasks produced an extensive annotated bibliography of bionics research (282 citations), a directory of bionics researchers, and a workshop report on specific bionics research topics applicable to space technology. These deliverables are included as Appendix A, Appendix B, and Section 5.0, respectively. To provide organization to this highly interdisciplinary field and to serve as a guide for interested researchers, we have also prepared a taxonomy or classification of the various subelements of natural engineering systems. Finally, we have synthesized the results of the various components of this study into a discussion of the most promising opportunities for accelerated research, seeking solutions which apply engineering principles from natural systems to advanced aerospace problems. A discussion of opportunities within the areas of materials, structures, sensors, information processing, robotics, autonomous systems, life support systems, and aeronautics is given. Following the conclusions are six discipline summaries that highlight the potential benefits of research in these areas for NASA's space technology programs. Author

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AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

A92-17772

SURGERY IN SPACE - SURGICAL PRINCIPLES IN A NEUTRAL BUOYANCY ENVIRONMENT

RICHARD M. SATAVA (Silas B. Hays Army Hospital, Monterey, CA) IN: Space manufacturing 8 - Energy and materials from space; Proceedings of the 10th Princeton/AIAA/SSI Conference, Princeton, NJ, May 15-18, 1991. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 187-189. refs Copyright

Surgical procedures were experimentally conducted on 20 rats in a simulated weightlessness environment, using neutral buoyancy to identify those factors which could affect the conduct of such procedures in space. Tissue planes are found to separate; organs float in the operative region, rendering clamping, cutting, and suturing very different from conventional operations. Blood dispersion in weightlessness easily obscures the surgeon's vision. The difficulties inherent in a comparison of neutral buoyancy to the true zero gravity of outer space are addressed. O.C.

A92-17875

THE INFLUENCE OF VISUAL CUE UPON THE CENTER OF FOOT PRESSURE (CFP) AND MUSCLE ACTIVITIES IN POSTURE CONTROL - RED LAMP GAZE IN DARK ROOM

NORIKO NITAMI, MIKIO ONO, and HIROSHI OSADA Japan Air Self Defense Force, Aeromedical Laboratory, Reports (ISSN 0023-2858), vol. 31, Dec. 1990, p. 85-97. In Japanese. refs

The influence of limited visual information on posture control is investigated by studying the bodily movements and sways in subjects focused on a red lamp in a dark room. The subjects maintain either Romberg's or Mann's posture, and the body-fat ratio is found to be correlated with body sways in the former and in the latter with the displacement density of the center of foot pressure. Red-lamp gaze tends to reduce the individual variation of the body sways, and posture control during limited visual information is related to the loss of the peripheral visual field. C.C.S.

A92-17924**THE ENVIRONMENTAL EFFECTS OF RADIATION ON FLIGHT CREWS**

C. W. CONNOR Cockpit (ISSN 0742-1508), July-Aug. 1991, p. 4-11.

A review is presented of a continuing investigation of flight deck radiation and its potential effects on flight crews. Attention is given to the various critical factors concerned in UV radiation exposure and detection including skin cancer classifications, skin types, effectiveness of different sun protection factors, and flight deck color configuration and sunglasses. Consideration is given to both UV and ionizing radiation. R.E.P.

A92-18209

EARLY SYMPTOMS OF DECREASED RESISTANCE TO PASSIVE ORTHOSTATIC LOAD [RANNIE PRIZNAKI SNIZHENIIA USTOICHIVOSTI K PASSIVNOMU ORTOSTATICHESKOMU VOZDEISTVIU]

V. A. GALICHII (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 17, July-Aug. 1991, p. 27-34. In Russian. refs

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The dynamics of changes in the respiratory-system indices during the application of passive orthostatic load (POD) was investigated in human subjects with different tolerances to POD, by measuring the parameters of external respiration during the 10 min in which the subjects were in supine position (control period) on an orthostatic platform and during the first 7 min after the platform was raised to a 70-deg head-up position. Changes recorded during the application of POD in the values of the minute respiration volume, respiration rate, oxygen uptake, CO₂ production, partial O₂ and CO₂ pressures, alveolar-ventilation index, and the coefficients of respiration and oxygen uptake were related to hyperventilation, hypocapnia, and circulation instability. I.S.

A92-18210

EFFECTS OF PROLONGED HYPOKINESIA AND WEIGHTLESSNESS ON THE FUNCTIONAL STATE OF SKELETAL MUSCLES IN HUMANS - USE OF AN ELECTROMECHANICAL EFFICIENCY CRITERION [VLIANIE DLITEL'NOI GUPOKINEZII I NEVESOMOSTI NA FUNKTSIONAL'NOE SOSTOYANIE SKELETNYKH MYSHTS CHELOVEKA - OPYT ISPOL'ZOVANIYA KRITERIYA ELEKTROMEKHANICHESKOI EFFEKTIVNOSTI]

V. S. OGANOV, V. S. GURFINKEL', V. G. KOZLOVA, A. S. RAKHMANOV, and V. S. MAGEDOV (Institut Mediko-Biologicheskikh Problem; AN SSSR, Institut Problem Peredachi Informatsii, Moscow, USSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 17, July-Aug. 1991, p. 35-47. In Russian. refs

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The effects of prolonged hypokinesia and weightlessness on the physiological state of skeletal muscles were investigated in humans subjected to prolonged antiorthostatic hypokinesia (182 days of staying in bed or 3 days of water immersion) or to 140 to 175 days of orbital flight, by measuring the dynamics of changes in electromyographic parameters of m. gastrocnemius and m. tibialis anterior before and after the exposures. Some subjects received supplementary salt additions and were performing exercises in order to test the effect of antihypokinesia measures. As a criterion of the physiological state of a muscle, an inverse function of the electromyographic integral energy, termed the electromechanical efficiency (EME) criterion, was used. It was found that the EME criterion describes well the changes in basic physiological characteristics of a muscle observed during hypokinesia. I.S.

A92-18211

REDISTRIBUTION OF BLOOD VOLUME IN HUMANS AFTER CHANGES OF POSTURE, DEPENDING ON THE STATE OF HYDRATION OF THE ORGANISM [PERERASPREDELENIE TSIRKULIRUIUSHCHEI KROVI PRI IZMENENII POLOZHENIYA TELA CHELOVEKA V ZAVISIMOSTI OT UROVNIA GIDRATATSII ORGANIZMA]

V. B. NOSKOV, V. I. LOBACHIK, S. V. ABROSIMOV, V. V. ZHIDKOV, D. K. ENDEKA, and O. N. RUSTAM'IAN (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 17, July-Aug. 1991, p. 48-53. In Russian. refs

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The effect of furosemid-induced dehydration on the distribution of the circulating blood volume (CBV) along the body axis of humans subjected to 3 days of antiorthostatic hypokinesia (head-down bed-rest at -15 deg) was investigated, using nucleophysical methods to assess CBV distribution. Results were compared with those obtained in the control (horizontal) position. It was found that, the furosemid intake of subjects in antiorthostatic hypokinesia (ANOI) led to general hypohydration, a decrease of CBV, and a decreased blood volume in cranial blood vessels. Three days after the combined effects of diuretic and ANOI, the CBV remained at a low level and the structure of blood distribution along the body axis remained unchanged. The effects caused by the intake of the diuretic were found to benefit the general state of the subjects' health. I.S.

A92-18212

INDIVIDUAL PECULIARITIES OF CARDIORESPIRATORY-SYSTEM REACTIONS DURING ADAPTATION TO HIGH ALTITUDES [INDIVIDUAL'NYE OSOBNOSTI REAKTSII KARDIORESPIRATORNOI SISTEMY U CHELOVEKA PRI ADAPTATSII K VYSOKOGOR'IU]

F. A. SHUKUROV, I. G. NIDEKKER, and E. E. BRODETSKAIA (Tadzhikskii Gosudarstvennyi Meditsinskii Institut, Dushanbe, Tadzhik SSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 17, July-Aug. 1991, p. 105-108. In Russian. refs

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The information content of a functional test termed 'controlled hyperventilation' for determining the degree of adaptation of a human subject to high altitude is investigated together with the dependence of the adaption on the type of cardiorespiratory-system reactions. The ECG parameters, measured with subjects at rest and after taking a hyperventilation test, of male subjects residing at 840 m altitude were compared with ECG parameters of the same subjects on the 12-15th and 50-55th day after these were transferred to an altitude of 3660 km. It is shown that the types of reactions obtained from these subjects can be used as qualitative criteria for estimating the physiological state of a subject under normal conditions or during adaptation to elevated altitude. I.S.

A92-18213

THE ZONE OF THERMAL NEUTRALITY DURING SEASONAL ADAPTATION OF HUMANS TO HIGH TEMPERATURE [ZONA TERMICHESKOI NEITRAL'NOSTI PRI SEZONNOI ADAPTATSII CHELOVEKA K VYSOKOI TEMPERATURE]

M. D. KHUDAIBERDIEV (AN TSSR, Institut Fiziologii i Eksperimental'noi Patologii Aridnoi Zony, Ashkhabad, Turkmen SSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 17, July-Aug. 1991, p. 126-131. In Russian. refs

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The effect of seasonal adaptation on the 'thermal neutrality zone' (defined as the ambient temperature at which the regulation of the body temperature can be accomplished without metabolic regulation) was investigated in human subjects placed in a thermal chamber, whose body temperature was measured during a temperature decrease from 28 C to 19-22 C, followed by an increase to 40 C. It was found that the thermal neutrality zone was 14 C in winter and -8 C in summer, indicating that seasonal adaptation to high temperatures caused a narrowing of the thermal stability zone. I.S.

A92-18214

DEPENDENCE OF FUNCTIONAL PARAMETERS ON THE HEMOLYTIC STABILITY OF ERYTHROCYTES IN THE ASSESSMENT OF THE DEGREE OF ADAPTATION [ZAVISIMOST' FUNKSIONAL'NYKH POKAZATELEI OT GEMOLITICHESKOI USTOICHIVOSTI ERITROTSITOV V OTSENKE SOSTOIANIIA ADAPTATSII]

V. P. CHIRKOV and V. P. BORDUNOVSKAIA (Cheliabinskii Gosudarstvennyi Meditsinskii Institut, Chelyabinsk, USSR) Fiziologiya Cheloveka (ISSN 0131-1646), vol. 17, July-Aug. 1991, p. 175, 176. In Russian. refs
Copyright

A92-18221

THE FEASIBILITY FOR A PILOT TO RECOGNIZE HYPOXIA WHILE FLYING AT HIGH ALTITUDE [O VOZMOZHNOSTI RASPOZNAVANIYA LETCHIKOM GIPOKSII V VYSOTNOM POLETE]

I. N. CHERNIAKOV, V. I. PRODIN, and A. A. SHISHOV Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), July 1991, p. 64-66. In Russian. refs
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The feasibility of a pilot's perceiving the severity of his own hypoxic condition was investigated in subjects exposed to 8-km simulated altitude in a pressure chamber. The autodiagnosis test was conducted with subjects at rest, during a written arithmetic test or during operation of a flight simulator. The ability of a subject to take necessary measures (such as opening an oxygen valve or turning on the device permitting an influx of 100 percent O₂) against the onset of hypoxic condition was estimated according to the accuracy of performing these activities. It was found that the ability of perceiving the extent of hypoxia differed in different individuals. However, the ability to perceive the dangerous level of hypoxia increased upon repeated exposures to hypoxia. I.S.

A92-18222

PHARMACOLOGICAL MEANS FOR INCREASING THE ORGANISM'S RESISTANCE IN SAILORS - REVIEW OF THE LITERATURE [FARMAKOLOGICHESKIE SREDSTVA POVYSHENIYA REZISTENTNOSTI ORGANIZMA MORIAKOV - OBZOR LITERATURY]

V. N. BORTNOVSKII Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), July 1991, p. 66-69. In Russian. refs
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Results of studies of the ability of various pharmacological compounds to boost up resistance in sailors to adverse environmental and psychological factors are reviewed, and the possible mechanisms of the activity of these compounds are discussed. Consideration is given to 'adaptogens' of vegetative origin (such as extracts of ginseng, Leuzea, and shizandra) and synthetic preparations (dibazole and imidazole derivatives) that were found to increase body resistance and stimulate energy exchange. Special attention is given to effective antioxidants, such as cytochrome c, some vitamins, and preparations which combine various biological agents (such as Aerovit and Komplevit), which increase resistance to extreme stress. Results are presented showing that compounds stimulating psychotropic effects are also active stimulants of immunoresistance. I.S.

A92-18240

HORMONAL AND METABOLIC STATE OF AN ORGANISM EXPOSED TO EXTREME ENVIRONMENTAL CONDITIONS [GORMONAL'NO-METABOLICHESKII STATUS ORGANIZMA PRI EKSTREMAL'NYKH VOZDEISTVIIKH]

RUBEN A. TIGRANIAN Moscow, Izdatel'stvo Nauka, 1990, 288 p. In Russian. refs
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Results are presented from investigations of the effects of unfavorable environments and conditions such as hypokinesia, hypoxia, low temperature, high acceleration, physical and vestibular loads, emotional stress, and cerebral ischemia on the activity of hormonal systems and the metabolic apparatus of the human organism. Experimental results are presented showing changes

undergone under these conditions in the circadian dynamics of various hormones, enzymes, and various parameters of the carbohydrate, lipid, and protein metabolisms. Measures that can be taken to prevent these effects are discussed. I.S.

A92-18543* National Aeronautics and Space Administration, Washington, DC.

THE NASA RADIATION HEALTH PROGRAM

A. E. NICOGLOSSIAN and W. SCHIMMERLING (NASA, Washington, DC) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 7 p. refs
(IAF PAPER 91-544) Copyright

The NASA program for determining the impact of cosmic radiation on health is described in terms of its long-term goal of reducing the uncertainty of radiation-model prediction to ± 25 percent by 2010. The Space Radiation Health Program (SRHP) is intended to address fundamental issues for establishing a scientific basis for human radiation protection: (1) the prediction of the probability of biological effects from radiation; (2) the reduction of uncertainty in predicted highly charged energetic particles; and (3) the characterization of background flux from Galactic cosmic rays. Another key objective is to develop related technologies for ground- and space-based solar monitoring to predict events involving solar energetic particles. Although substantial uncertainties are involved in the prediction of such events, the SRHP is essential for determining crucial variables related to launching mass and humans into orbit. C.C.S.

A92-18544* National Aeronautics and Space Administration, Washington, DC.

MEDICAL CONCERNS FOR EXPLORATION-CLASS MISSIONS

DONALD F. STEWART and BARBARA LUJAN (NASA, Washington, DC) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 11 p. refs
(IAF PAPER 91-546) Copyright

The Space Exploration initiative will challenge life scientists with a diverse set of crew medical risks. The varied sources of this cumulative risk are identified and briefly discussed in terms of risk assessment and preliminary plans for risk management. The roles of Space Station Freedom and other flight programs are discussed in the context of exploration medical objectives. The significant differences between Space Station era (second generation) and exploration medical support systems (third generation) are reviewed. Author

A92-18545

MAJOR MEDICAL RESULTS OF EXTENDED FLIGHTS ON SPACE STATION MIR IN 1986-1990

A. I. GRIGOR'EV, S. A. BUGROV, V. V. BOGOMOLOV, A. D. EGOROV, V. V. POLIAKOV, I. K. TARASOV, and E. B. SHUL'ZHENKO (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 7 p. refs
(IAF PAPER 91-547) Copyright

In 1986-1990 seven prime spacecrews (16 cosmonauts) flew on board Mir orbital complex. The longest duration of space mission was 366 days. Microgravity effects on the cardiovascular, motor, endocrine, blood, immune and metabolic were studied. The performed investigations point to the human possibility to adapt well to a year-long stay in space and to maintain good health and adequate performance. The readaptation has occurred in a similar way as it was after other long-term space flight up to 8 months in duration. Author

A92-18546

PROBING HEART RATE AND BLOOD PRESSURE CONTROL MECHANISMS DURING GRADED LEVELS OF LOWER BODY NEGATIVE PRESSURE (LBNP)

Y. YAMAMOTO, H. C. XING, D. R. NORTHEY, R. L. HUGHSON (Waterloo, University, Canada), and G. C. BUTLER IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 10 p. Research supported by NSERC. refs
(IAF PAPER 91-549) Copyright

Two new approaches for the investigation of cardiovascular regulation during LBNP orthostatic stress are presented. It is shown that progressively greater levels of LBNP are associated with an increase in sympathetic nervous system activity and reductions in both parasympathetic nervous activity and fractal dimension. It is also shown that noninvasive techniques of data collection can provide information about the status of the cardiovascular system during orthostatic stress when combined with appropriate methods for data analysis. R.E.P.

A92-18547

EVALUATION OF SPONTANEOUS BAROREFLEX RESPONSE AFTER 28 DAYS HEAD DOWN TILT BEDREST

R. L. HUGHSON (Waterloo, University, Canada; Lyon I, Université, France), Y. YAMAMOTO, G. C. BUTLER (Waterloo, University, Canada), A. GUELL (MEDES, Toulouse, France), and C. GHARIB (Lyon I, Université, France) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 6 p. Research supported by CNES and NSERC. refs (Contract DRET-89-237) (IAF PAPER 91-550) Copyright

The purpose of this study was to evaluate the baroreflex response during supine rest and head up tilt (60 deg) before and immediately after a 28 day 6 deg HDT bedrest in 6 healthy adult men (age 30-42 years). The method determined the spontaneous baroreflex by evaluating beat-by-beat RR-interval from an electrocardiograph, and systolic blood pressure (SBP) from the Finapres, noninvasive continuous BP monitor. These observations from relatively simple noninvasive measurements of RR-interval and SBP show several important new findings: (1) the spontaneous baroreflex can be evaluated in human subjects during experiments of orthostatic stress; (2) the baroreflex slope is reduced on going from supine to the head up tilt position; and (3) 28 days of bedrest reduces the slope of the spontaneous baroreflex. Author

A92-18548* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

BIOCHEMICAL AND HEMATOLOGIC CHANGES AFTER SHORT-TERM SPACE FLIGHT

CAROLYN S. LEACH (NASA, Johnson Space Center, Houston, TX) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 8 p. refs (IAF PAPER 91-551) Copyright

Clinical laboratory data from blood samples obtained from astronauts before and after 28 flights (average duration = 6 days) of the Space Shuttle were analyzed by the paired t-test and the Wilcoxon signed-rank test and compared with data from the Skylab flights (duration = 28, 56, and 84 days). Angiotensin I and aldosterone were elevated immediately after short-term space flights, but the response of angiotensin I was delayed after Skylab flights. Serum calcium was not elevated after Shuttle flights, but magnesium and uric acid decreased after both Shuttle and Skylab. Creatine phosphokinase in serum was reduced after Shuttle but not Skylab flights, probably because exercises to prevent deconditioning were not performed on the Shuttle. Total cholesterol was unchanged after Shuttle flights, but low density lipoprotein cholesterol increased and high density lipoprotein cholesterol decreased. The concentration of red blood cells was elevated after Shuttle flights and reduced after Skylab flights. Author

A92-18549

CIRCULATION AND FLUID ELECTROLYTE BALANCE IN EXTENDED SPACE MISSIONS

A. I. GRIGOR'EV and A. D. EGOROV (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 15 p. refs (IAF PAPER 91-552) Copyright

This paper presents the results of studies and possible mechanisms underlying changes of human circulation and fluid electrolyte balance in long duration space missions. Circulation changes were measured at rest, in response to graded exercise tests and lower body negative pressure tests. Fluid electrolyte

balance before and after flight was measured with reference to changes in plasma electrolytes, spontaneous renal excretion of fluids and electrolytes in response to water and water salt supplements. Author

A92-18550

DYNAMIC ANALYSIS OF OCULAR TORSION IN PARABOLIC FLIGHT USING VIDEO-OCULOGRAPHY

W. TEIWES, A. H. CLARKE, and H. SCHERER (Klinikum Steglitz, Berlin, Federal Republic of Germany) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 4 p. Research supported by Deutsche Agentur fuer Raumfahrtangelegenheiten GmbH. refs (IAF PAPER 91-553) Copyright

In a preliminary study for a full space mission experiment, dynamic ocular torsion was recorded and analyzed during parabolic flight. The varying gravito-inertial forces developed during parabolic maneuvers represent an appropriate means of stimulating the vestibular system with considerable variations in linear acceleration. Dynamic analysis of ocular counterrolling during the transitions from hypogravity to hypergravity and during the intermediate intervals of microgravity was conducted. R.E.P.

A92-18551* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

COMPARISON OF TREATMENT STRATEGIES FOR SPACE MOTION SICKNESS

J. R. DAVIS, R. T. JENNINGS, and B. G. BECK (NASA, Johnson Space Center, Houston, TX) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 6 p. refs (IAF PAPER 91-554) Copyright

Treatment strategies for space motion sickness were compared using the results of postflight oral debriefings. Standardized questionnaires were administered to all crewmembers immediately following Space Shuttle flights by NASA flight surgeons. Cases of space motion sickness were graded as mild, moderate, or severe based on published criteria, and medication effectiveness was judged based on subjective reports of symptom relief. Since October 1989, medication effectiveness is reported inflight through private medical conferences with the crew. A symptom matrix was analyzed for nineteen crewmembers treated with an oral combination of scopolamine and dextroamphetamine (scopdex) and fifteen crewmembers treated with promethazine delivered by intramuscular or suppository routes. Scopdex has been given preflight as prophylaxis for space motion sickness but analysis showed delayed symptom presentation in nine crewmembers or failed to prevent symptoms in seven. Author

A92-18552

THE INFLUENCE OF INCREASED GRAVITOINERTIAL FORCES ON THE VESTIBULO-OCULOMOTOR RESPONSE

A. H. CLARKE, W. KRZOK, H. SCHERER, U. SPANGENBERG (Klinikum Steglitz, Berlin, Federal Republic of Germany), H. LEIPNER, P. LINDNER, W. PAPENFUSS, and K. ZOLLNER (Institute of Aviation Medicine, Dresden, Federal Republic of Germany) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 3 p. refs (IAF PAPER 91-555) Copyright

Two series of human centrifuge experiments are reported. The first involves the caloric nystagmus response under increased gravito-inertial conditions. G-level increments of 0.5 G from 1 to 3 G were employed. Caloric stimulations was presented by unilateral air insufflation, and the centrifuge cabin was pitched to the presumed 'optimum' and 'pessimum' positions for caloric response. The second experiment was designed to evaluate dynamic ocular torsion elicited by purely linear acceleration. Thus, the roll and pitch axes of the centrifuge cabin were actively controlled to direct the centrifugal component parallel to the utricular and the saccular planes, respectively. Eye movements were recorded and analyzed by means of video-oculography, enabling evaluation of horizontal, vertical and torsional components. Author

A92-18553**EFFECTS OF UNILATERAL SELECTIVE HYPERGRAVITY STIMULATION ON GAIT**

M. LAZERGES and P. BESSOU (Toulouse III, Université, France) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 9 p. Research supported by CNES, MATRA, Fondation pour la Recherche Médicale Française, et al. refs (IAF PAPER 91-556) Copyright

The purpose of this work is to analyze the neural mechanisms of human motor perturbations induced by dynamic changes in gravity. A unilateral selective hypergravity stimulation (USHS) was produced by stretching an elastic thread between the right shoulder and foot. The consequences of the extensor muscles tone change consecutive to the positioning (muscular solicitation increase) and to the removing (muscular solicitation decrease) of the elastic thread were observed on gait motor skill. The gait spatial and temporal parameters (horizontal displacement of both feet) and the inferior limb functional length variations (efficiency of flexion and extension movements of the inferior limbs) were measured. The main results were: (1) during and after USHS, walk perturbations appearing on the left, not directly stimulated body side; (2) just after the USHS end, perturbations on right (homolateral) side, evidencing a post-effect which induces a decrease of the functional shortening of the inferior limb during swing and an increase of the functional shortening of the inferior limb during stance (opposite sense to the modification observed during swing). Such results afford evidences that, in addition to the vestibular receptors, the mechanoreceptors of the extensor muscles are involved in the determinism of motor skills perturbations observed at the beginning and at the end of space flights. Author

A92-18554**PREVENTION OF BONE LOSS AND MUSCLE ATROPHY DURING MANNED SPACE FLIGHT**

T. S. KELLER (Vermont, University, Burlington), A. M. STRAUSS (Vanderbilt University, Nashville, TN), and M. SZPILSKI (C.H. Molière Longchamp, Brussels, Belgium) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 14 p. refs

(IAF PAPER 91-557) Copyright

This paper focuses on the definition of practical countermeasures necessary for long-term survival on the moon, Mars and during long-term space missions and exploration. Of particular importance is the development of clinically relevant countermeasures for prevention of pathophysiological changes in the musculoskeletal and cardiopulmonary systems under these conditions. The countermeasures which are proposed are based upon a combination of biomechanical and theoretical analyses. The biomechanical analyses are based upon on clinical measurements of human skeletal density changes associated with weight lifting as well as clinical studies of human strength and fitness currently being conducted using an isoinertial trunk dynamometer. Author

A92-18558**PRE-ADAPTATION TO SHIFTWORK IN SPACE**

A. SAMEL, H. M. WEGMANN, and M. VEJVODA (DLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 8 p. refs

(IAF PAPER 91-564) Copyright

The combined effects are investigated of altered sleep/wake cycles and microgravity to assess the ramifications of premission adaptation for space missions with shift schedules. For 25 days 8 subjects were subjected to a D-2 mission schedule after 7 days of progressively shortened sleep cycles in combination with microgravity simulation by means of a head-down bedrest. The circadian system was monitored with ECG and temperature measurements, and urine samples are collected. The data are analyzed to determine the rate of physiological adaptation afforded by preadaptation to achieve adequate resynchronization. The 7-day premission adaptation of one hr/day does not adequately keep

the circadian rhythm in pace under the conditions of the investigation. The corresponding synchronization under real mission conditions introduces more variables suggesting that a longer period of circadian-system adjustment is needed. C.C.S.

A92-18596**SKELETAL MUSCLE CHANGES AFTER ENDURANCE TRAINING AT HIGH ALTITUDE**

A. X. BIGARD, A. BRUNET, C. Y. GUEZENNEC, and H. MONOD (Centre d'Etudes et de Recherches de Médecine Aérospatiale, Bretigny; CNRS, Laboratoire de Physiologie de la Motricité, Paris, France) Journal of Applied Physiology (ISSN 0161-7567), vol. 71, Dec. 1991, p. 2114-2121. refs Copyright

The effects of endurance training on the skeletal muscle of rats have been studied at sea level and simulated high altitude (4000 m). Male Wistar rats were randomly assigned to one of four groups: exercise at sea level, exercise at simulated high altitude, sedentary at sea level, and sedentary at high altitude. Training consisted of swimming for 1 h/day in water at 36°C for 14 wk. Training and exposure to a high-altitude environment produced a decrease in body weight. There was a significant linear correlation between muscle mass and body weight in the animals of all groups. High-altitude training enhanced the percentage of type IIa fibers in the extensor digitorum longus muscle and deep portions of the plantaris muscle. High-altitude training also increased the percentage of type IIab fibers in fast-twitch muscles. These muscles showed marked metabolic adaptations: training increased the activity levels of enzymes involved in the citric acid cycle and the beta-oxidation of fatty acids. Author

A92-18597**FREQUENCY DOMAIN ANALYSIS OF VENTILATION AND GAS EXCHANGE KINETICS IN HYPOXIC EXERCISE**

HUA CHENG XING, JAMES E. COCHRANE, YOSHIHARU YAMAMOTO, and RICHARD L. HUGHSON (Waterloo, University, Canada) Journal of Applied Physiology (ISSN 0161-7567), vol. 71, Dec. 1991, p. 2394-2401. Research supported by NSERC. refs

Copyright

The impact of hypoxia on the relationship between the input work rate function and the output cardiorespiratory response has been examined over a large range of input frequencies. Eight male subjects completed on- and off-step transitions in work rate (WR) and a pseudorandom binary sequence (PRBS) exercise test. The impact of hypoxia on the responses of O₂ uptake (VO₂), CO₂ output (VCO₂), ventilation (VE), and heart rate (HR) is found to be qualitatively similar whether or not the subjects completed step or PRBS exercise tests. It is concluded that hypoxia exerts the greatest influence on the more slowly adapting phases of each measure of VO₂, VCO₂, VE, and HR. The more rapidly adapting phases of the responses were not affected by hypoxia. O.G.

A92-18600* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

TRANSCAPILLARY FLUID SHIFTS IN TISSUES OF THE HEAD AND NECK DURING AND AFTER SIMULATED MICROGRAVITY

A. R. HARGENS, B. TUCKER, M. ARATOW, J. STYF, A. CRENSHAW (NASA, Ames Research Center, Moffett Field, CA), and S. E. PARAZYNSKI (Denver General Hospital, CO) Journal of Applied Physiology (ISSN 0161-7567), vol. 71, Dec. 1991, p. 2469-2475. Previously announced in STAR as N91-23704. refs Copyright

To understand the mechanism, magnitude, and time course of facial puffiness that occurs in microgravity, seven male subjects were tilted 6 degrees head down for 8 hr, and all four Starling transcapillary pressures were directly measured before, during, and after tilt. Head-down tilt (HDT) caused facial edema and a significant elevation of microvascular pressures measured in the lower lip. Subcutaneous and intramuscular interstitial fluid pressures in the neck also increased as a result of HDT, while interstitial

fluid colloid osmotic pressures remained unchanged. Plasma colloid osmotic pressures dropped significantly after 4 hr of HDT, suggesting a transition from fluid filtration to absorption in capillary beds between the heart and feet during HDT. After 4 hr of seated recovery from HDT, microvascular pressures remained significantly elevated by 5 to 8 mm Hg above baseline values despite a significant HDT diuresis and the orthostatic challenge of an upright, seated posture. During the control (baseline) period, urine output was 46.7 ml/hr; during HDT, it was 126.5 ml/hr. Author

A92-19065

EFFECT OF HYPERHYDRATION OF BONE MINERALIZATION IN PHYSICALLY HEALTHY SUBJECTS AFTER PROLONGED RESTRICTION OF MOTOR ACTIVITY

YAN G. ZORBAS, YURI F. FEDERENKO, and KONSTANTIN A. NAEXU (Academy of Medical Sciences, Institute of Normal and Pathological Physiology, Bucharest, Romania) *Acta Astronautica* (ISSN 0094-5765), vol. 25, Nov. 1991, p. 727-731. refs Copyright

The effect of a daily intake of fluid and salt supplementation (FSS) hyperhydration on bone mineralization in physically healthy subjects was evaluated after exposure to hypokinesia over 364 days. The subjects were divided into three equal groups of six, one of which underwent a normal ambulator life, one of which were placed under HK and were kept under an average of 1000 steps/day, and one of which were subject to HK and consumed a daily FSS. Ca content in examined skeletal bones decreased more in the HK subjects than in the FSS subjects. Urinary Ca and P losses were more pronounced in HK than FSS subjects. Plasma volume and body weight increased in FSS subjects and decreased in HK subjects. It was concluded that a daily intake of FSS may be used to neutralize bone demineralization in physically healthy subjects during prolonged restriction of motor activity. C.D.

A92-19070

THE DISTRIBUTION OF SOLAR FLARES AND PROBABLE RELATIONS TO BIOLOGICAL EFFECTS

BASILE PETROPOULOS and CONSTANTINE POULAKOS (Athens, Academy, Research Centre for Astronomy and Applied Mathematics, Greece) *Earth, Moon, and Planets* (ISSN 0167-9295), vol. 55, Oct. 1991, p. 1-19. refs Copyright

The monthly distribution of the total number of flares is compared to the monthly mortality from cardiovascular and myocardial infarctions for the time period 1974-1983, and correlation coefficients are computed. Periodicities of 3 and 5 months (150 days) are found in both distributions. Author

A92-20654

ELECTRICAL VESTIBULAR STIMULATION AND SPACE MOTION SICKNESS

ALEXANDRA SEVERAC (Toulouse III, Universite, France) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 9 p. Research supported by CNES and Dassault Aviation. refs (IAF PAPER ST-91-014) Copyright

Electrical vestibular stimulation (EVS) in dynamic balance condition was studied in order to search for a new provocative test of space motion sickness (SMS). EVS was achieved by means of binaural electrical stimulation. Effects of EVS were potentiated by compelling the subject to maintain dynamic balance on a seesaw. The quantification of this function was performed before, during, and after EVS in order to investigate a possible relationship between objective consequences of EVS, i.e., dynamic balance disturbances, and the discomfort experienced by the subjects. Dynamic balancing skill was statistically worsened during EVS. Moreover, EVS evoked subjective symptoms of SMS in 17 out of the 30 subjects examined. Author

A92-20711

RESULTS OF A 4-WEEK HEAD-DOWN TILT WITH AND WITHOUT LBNP COUNTERMEASURE. I - VOLUME REGULATING HORMONES

CLAUDE GHARIB, ALAIN MAILLET, GUILLEMETTE GAUQUELIN, ANNE-MARIE ALLEVARD (Lyon I, Universite, Lyons, France), ANTONIO GUELL (CNES, Toulouse, France), REGINE CARTIER (Hopital Neuro-Cardiologique, Lyons, France), and PHILLIPPE ARBEILLE (Institut National de la Sante et de la Recherche Medicale, Tours, France) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 63, Jan. 1992, p. 3-8. Research supported by CNES and Fondation pour la Recherche Medicale. refs

(Contract DRET-87-856; DRET-89-237)

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The hormones are investigated under simulated microgravity conditions to evaluate the effect of lower-body negative pressure (LBNP) in five subjects. Physical parameters are studied during and following 4 weeks of head-down tilt, of which three weeks included three LBNP applications and the last week included 4-6 applications. Of note are decreased body weight, increased plasma-renin activity and aldosterone, and major reductions in norepinephrine in all of the participants. The LBNP group is found to have increased levels of atrial natriuretic factor (ANF), and the finding is compared to the improved orthostatic tolerance associated with the LBNP treatment. ANF appears to decrease because the plasma volume is not as well conserved in the subjects that do not receive LBNP, and a relationship with orthostatic tolerance is considered. C.C.S.

A92-20712

RESULTS OF A 4-WEEK HEAD-DOWN TILT WITH AND WITHOUT LBNP COUNTERMEASURE. II - CARDIAC AND PERIPHERAL HEMODYNAMICS: COMPARISON WITH A 25-DAY SPACEFLIGHT

PH. ARBEILLE, J. M. POTTIER, L. POURCELOT (Institut National de la Sante et de la Recherche Medicale, Tours, France), G. GAUQUELIN, C. GHARIB (Lyon I, Universite, Lyons, France), and A. GUELL (CNES, Toulouse, France) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 63, Jan. 1992, p. 9-13. Research supported by CNES. refs Copyright

The present paper describes the performance of the cardiovascular function during either a 28-d head-down tilt (HDT) or a 25-d spaceflight to determine the effect of repeated applications of lower-body negative pressure (LBNP). The experimental and control subjects' vascular areas are examined to evaluate renal and intracerebral circulation by means of measured hemodynamic parameters. Cardiac volumes and cardiac output are found to be decreased in the control group, whereas these parameters are found to be greater than their basal values in the subjects with LBNP. The non-LBNP group demonstrates lost vasomotor control and orthostatic intolerance following the HDT, and these phenomena are not associated with the LBNP group. The test results indicate that vascular deconditioning develops almost immediately in the absence of countermeasures in both HDT and spaceflight situations. C.C.S.

A92-20713* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

EFFECTS OF 1-WEEK HEAD-DOWN TILT BED REST ON BONE FORMATION AND THE CALCIUM ENDOCRINE SYSTEM

SARA B. ARNAUD, ROBERT T. WHALEN, PAUL FUNG (NASA, Ames Research Center, Moffett Field, CA), DONALD J. SHERRARD, and NORMA MALONEY (Washington, University; USVA, Medical Center, Seattle) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 63, Jan. 1992, p. 14-20. Research supported by NASA and USVA. refs Copyright

The -6-deg head-down tilt (HDT) is employed in the study of 8 subjects to determine early responses in human bone and calcium endocrines during spaceflight. The average rates of bone formation in the iliac crest are determined by means of a single-dose labeling

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schedule and are found to decrease in 6 of the subjects. The decrease varies directly with walking miles, and increased excretion of urinary Ca and Na are observed preceding increased levels of ionized serum calcium on a bed-rest day late in the week. Reduced phosphorous excretions are also followed by increased serum phosphorous on day six, and reductions are noted in parathyroid hormone and vitamin D by the end of the experiment. The data demonstrate the responsiveness of the skeletal system to biomechanical stimuli such as the HDT. C.C.S.

A92-20714

ASSESSMENT OF CARDIOVASCULAR REFLEXES IS OF LIMITED VALUE IN PREDICTING MAXIMAL +GZ-TOLERANCE

E. J. VAN LIESHOUT (Royal Netherlands Air Force, Dept. of Aviation Medicine; Netherlands Aerospace Medical Center, Soesterberg), J. J. VAN LIESHOUT (Academic Medical Center, Dept. of Intensive Care, Amsterdam, Netherlands), J. KROL, M. SIMONS (Netherlands Aerospace Medical Center, Soesterberg), and J. M. KAREMAKER (Amsterdam, University, Netherlands) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, Jan. 1992, p. 21-26. refs

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Relationships are investigated between +Gz tolerance and cardiovascular responses to maneuvers such as the Valsalva maneuver, standing, and forced respiratory sinus arrhythmia. Blood pressure and heart rate are monitored in the subjects to evaluate the integrity of neural cardiovascular reflex control. The G-levels of peripheral-light loss are assessed in centrifuge runs and are correlated with the blood-pressure and heart-rate measurements. Mean blood-pressure recovery is the only parameter that is found to correlate significantly with peripheral-light loss as evinced during the Valsalva maneuver. Intact neural-cardiovascular control is theorized to be a condition for tolerating +Gz-stress, but cardiovascular responses are only successful in indicating baroreflex integrity. C.C.S.

A92-20716

THE RELATIONSHIP BETWEEN HEAD AND NECK ANTHROPOMETRY AND KINEMATIC RESPONSE DURING IMPACT ACCELERATION

STEPHEN V. MAWN, JAMES J. LAMBERT, and JOSEPH L. CATYB, JR. (U.S. Navy, Naval Biodynamics Laboratory, New Orleans, LA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, Jan. 1992, p. 32-36. refs

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The response and anthropometry data from acceleration tests of 15 subjects are employed to derive correlations between head/neck morphology and physical effects of the tests. Several vector directions are considered including -X, +Y, +Z, and combinations of the vectors, and data are taken from nitrogen-propelled sled tests with a consistent peak acceleration of -10Gx. The initial positions of the head and neck are constrained in the data set to 30 consistent runs, and three critical output accelerations are examined for the head on each run. The data relating to the linear acceleration along the Z axis demonstrate a significant correlation with head and neck anthropometry; and other weaker correlations are noted with linear acceleration along the X axis and angular acceleration about the Y axis. The correlations are considered important for the selection of aircrew and for the development of protective equipment. C.C.S.

A92-20717

EFFECTS OF PYRIDOSTIGMINE BROMIDE ON PHYSIOLOGICAL RESPONSES TO HEAT, EXERCISE, AND HYPOHYDRATION

C. B. WENGER and WILLIAM A. LATZKA (U.S. Army, Research Institute of Environmental Medicine, Natick, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, Jan. 1992, p. 37-45. refs

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A single oral dose of pyridostigmine is administered to subjects undergoing heat-stress tests to examine its impact on heart rate as well as thermoregulatory and fluid-balance responses. The tests

involve 25-min treadmill walks at 35 C with either: (1) 20 percent relative humidity (RH) with ad libitum drinking and euhydration; (2) 20 percent RH with euhydration; (3) 75 percent RH with euhydration; or (4) 20 percent RH with hypohydration at 3 percent of bodyweight. Heart rate is found to be lower during the heat tests by an overall mean of 3 beats/min in the subjects after taking pyridostigmine bromide. The substance has no effect on body temperature except that it reduces the rise in temperature during hypohydrated exercise. C.C.S.

A92-20718*

National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

TREATMENT OF MOTION SICKNESS IN PARABOLIC FLIGHT WITH BUCCAL SCOPOLAMINE

WILLIAM T. NORFLEET (Virginia Mason Hospital, Seattle, WA), JOSEPH J. DEGIOANNI, MILLARD F. RESCHKE, MICHAEL W. BUNGO, FRANK A. KUTYNA, JERRY L. HOMICK (NASA, Johnson Space Center, Houston, TX), and D. S. CALKINS (Krug Life Sciences, Inc., Houston, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, Jan. 1992, p. 46-51. refs

Copyright

Treatment of acute motion sickness induced by parabolic flight with a preparation of scopolamine placed in the buccal pouch was investigated. Twenty-one subjects flew aboard a KC-135 aircraft operated by NASA which performed parabolic maneuvers resulting in periods of 0-g, 1-g, and 1.8-g. Each subject flew once with a tablet containing scopolamine and once with a placebo in a random order, crossover design. Signs and symptoms of motion sickness were systematically recorded during each parabola by an investigator who was blind to the content of the tablet. Compared with flights using placebo, flights with buccal scopolamine resulted in significantly lower scores for nausea (31-35 percent reduction) and vomiting (50 percent reduction in number of parabolas with vomiting). Side effects of the drug during flight were negligible. It is concluded that buccal scopolamine is more effective than a placebo in treating ongoing motion sickness. Author

A92-20719

G-INDUCED LOSS OF CONSCIOUSNESS ACCIDENTS - USAF EXPERIENCE 1982-1990

TERENCE J. LYONS, RICHARD HARDING, JAMES FREEMAN, and CAROLYN OAKLEY (USAF, Armstrong Aerospace Medical Research Laboratory; USAF, Inspection and Safety Center, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, Jan. 1992, p. 60-66. refs

Copyright

A review of the 18 accidents attributable to loss of consciousness induced by high-G flight (G-LOC) is conducted to discuss potential acceleration-protection measures. The data show that all accidents are single-crewmember sorties, and the average is decreasing due to an anti-G-LOC training program. The pilots involved in the accidents are found to have significantly higher systolic blood pressure and fewer aircraft-specific flying hours than other pilots. The pilots seem to represent a typical cross section of the pilot pool in terms of personal variables. It is suggested that the most important variables contributing to the accidents are G duration, G magnitude, the use of G trousers, and experience with the aircraft in question. C.C.S.

A92-20723

PRESCRIBING SPECTACLES FOR AVIATORS - USAF EXPERIENCE

ROBERT E. MILLER, II, ROBERT P. GREEN, JR. (USAF, Armstrong Aerospace Medical Research Laboratory, Brooks AFB, TX), and JOHN F. KENT (USAF, Medical Center, Lackland AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, Jan. 1992, p. 80-85. refs

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This special report was written for USAF vision specialists to use as a guide when prescribing spectacles for military aviators and to extend to the civilian sector the knowledge gained from the USAF experience. Visual correction in aviators presents some unique problems, especially for presbyopes. The demands of each

individual aircraft environment need to be well understood. Ophthalmologists and optometrists must consider all pertinent aeromedical factors before prescribing spectacles for ametropic aviators. Author

N92-14584# Ecole Nationale Supérieure des Telecommunications, Paris (France). Dept. Images.
PATTERN RECOGNITION IN PULMONARY COMPUTERIZED TOMOGRAPHY IMAGES USING MARKOVIAN MODELING
FRANCOISE PRETEUX, MICHEL MOUBARAK, and PHILIPPE GRENIER (Hopital Salpetriere, Paris, France) Mar. 1991 17 p
Presented at the International Society for Optical Engineering and the Society for Imaging Science and Technology Symposium on Electronic Imaging Science and Technology, San Jose, CA, 24 Feb. - 1 Mar. 1991 Submitted for publication
(TELECOM-PARIS-91-C-002; ISSN-0751-1337; ETN-91-90116)
Copyright Avail: NTIS HC/MF A03

A nonstationary Markovian model with deterministic relaxation for segmenting the hyperattenuated areas in pulmonary computerized tomography is proposed. This contribution lies in the definition of a local energy as the weighted combination of four components: density function; the Geman-Graffigne gradient function; the local maxima function concerning cliques of order one; and the attraction-repulsion function as an Ising model dealing with cliques of order two. This potential is deduced from preprocessing and a priori knowledge. Spatial interactions are modeled on a hexagonal lattice. The six connectivity neighborhood system is defined by morphological dilations. An important aspect of the model is that it considers, in addition to the two classes normally used (hyperattenuated and nonhyperattenuated), a third class for nonidentifiable pixels. Results of this automatic segmentation perfectly match the areas interactively selected by the radiologists. ESA

N92-14585# International Centre for Theoretical Physics, Trieste (Italy).

THE EFFECT OF ULTRASOUND ON ARTERIAL BLOOD FLOW. PART 1: STEADY FULLY DEVELOPED FLOW

A. R. BESTMAN Dec. 1990 8 p
(DE91-635323; IC-90/447) Avail: NTIS HC/MF A02

The paper models the effects of ultrasound heating of the tissues and the resultant perturbation on blood flow in the arteries and veins. It is assumed that the blood vessel is rigid and the undisturbed flow is fully developed. Acoustical perturbation on this Poiseuille flow, for the general three-dimensional flow with heat transfer in an infinitely long pipe is considered. Closed form analytical solutions are obtained to the problem. It is discovered that the effects of the ultrasound heating are concentrated at the walls of the blood vessels. DOE

N92-14586*# Wright State Univ., Dayton, OH. Dept. of Pharmacology.

PHARMACOLOGICAL AND NEUROPHYSIOLOGICAL ASPECTS OF SPACE/MOTION SICKNESS Final Report, 1 Jan. 1986 - 31 Dec. 1991

JAMES B. LUCOT and GEORGE H. CRAMPTON 30 Dec. 1991 23 p
(Contract NCC2-229)
(NASA-CR-189521; NAS 1.26:189521) Avail: NTIS HC/MF A03
CSCL 06P

A motorized motion testing device modeled after a Ferris wheel was constructed to perform motion sickness tests on cats. Details of the testing are presented, and some of the topics covered include the following: xylazine-induced emesis; analysis of the constituents of the cerebrospinal fluid (CSF) during motion sickness; evaluation of serotonin-1A (5-HT sub 1A) agonists; other 5HT receptors; antimuscarinic mechanisms; and antihistaminergic mechanisms. The ability of the following drugs to reduce motion sickness in the cats was examined: amphetamines, adenosinergic drugs, opioid antagonists, peptides, cannabinoids, cognitive enhancers (nootropics), dextromethorphan/sigma ligands, scopolamine, and diphenhydramine. Author

N92-15534# Massachusetts General Hospital, Boston. Physics Research Lab.

NEW IMAGING SYSTEMS IN NUCLEAR MEDICINE

1991 7 p
(Contract DE-FG02-87ER-60519)
(DE92-000786; DOE/ER-60519/T3) Avail: NTIS HC/MF A02

We continue to use and maintain PCR-I, the single-slice high-resolution high-sensitivity positron emission tomograph, while development proceeds on PCR-II, a three-dimensional Positron Emission Tomography (PET) system. A two-dimensional bismuth germanate (BGO) scintillation detector has been designed and we are nearing completion of the detector, including the light guide, crystals and phototube assembly, and the gantry electronics. We are currently exploring techniques for a very high resolution (sub-mm) PET imaging system. We are using the current PCR-I system to assess changes in presynaptic dopamine receptors and glucose utilization in current biological models of Huntington's disease. Our preliminary studies support the use of the primate (*Cynomolgus* monkey) model of Huntington's disease to monitor in vivo functional changes. We are planning to extend this study to examine the MPTP model of Parkinson disease, and to assess the therapeutic value of D(sub 1) dopamine receptor agonists for treatment of (MPTP) induced neurological defects. DOE

N92-15535# SRI International Corp., Menlo Park, CA.

DEVELOPMENT OF A THERAPEUTIC AGENT FOR WOUND-HEALING ENHANCEMENT Quarterly Report No. 2

AMRIT K. JUDD Sep. 1991 10 p
(Contract N00014-91-C-0066)

(AD-A242529) Avail: NTIS HC/MF A02 CSCL 06/5

During this quarter, we synthesized and purified three peptides, one from PDGF A-chain sequence and two from PDGF B-chain sequence. We also conducted cell binding experiments and assays for mitogenesis. Competitive receptor binding assays were performed on four peptides using NIH 3T3 cells. None of the peptides tested so far showed any binding. We tested two peptides at three doses and two at four doses. In the future, we will test peptides initially at three doses. Active peptides will be tested at four or more doses. GRA

N92-15536# Missouri Univ., Kansas City.

GLYCYL-L-GLUTAMINE: A DIPEPTIDE NEUROTRANSMITTER DERIVED FROM BETA-ENDORPHIN Midterm Report, 3 Jan. 1990 - 31 Aug. 1991

WILLIAM R. MILLINGTON 1 Sep. 1991 36 p
(Contract DAMD17-90-Z-0022; DA PROJ. 3M1-61102-BS-12)
(AD-A242587) Avail: NTIS HC/MF A03 CSCL 06/5

The objective of this research is to test the hypothesis that glycyl-L-glutamine, a dipeptide synthesized through the post-translational processing of Beta-endorphin, acts as a neurotransmitter in the brain and a circulating hormone in the periphery. To test this hypothesis, we established three working objectives: (1) to evaluate the physiological responses produced by glycyl L glutamine and test whether it modulates the opiate actions of Beta-endorphin; (2) to examine its distribution in the brain and pituitary and determine whether it is specifically co-localized with Beta-endorphin; (3) to characterize the receptors which mediate glycyl L glutamine's pharmacologic effects. During the current project period, we found that glycyl L glutamine produces three markedly different pharmacologic responses: it stimulates a trophic response in cardiac myocytes, inducing expression of the asymmetric form of acetylcholinesterase, a classical marker for synaptic innervation; and it produces neuroimmune regulatory effects in T lymphocytes, enhancing c-myc oncogene expression. GRA

N92-15537# Naval Submarine Medical Research Lab., Groton, CT.

A CLINICAL TRIAL OF A COMPUTER DIAGNOSIS PROGRAM FOR CHEST PAIN Interim Report

S. M. LURIA, DAVID G. SOUTHERLAND, and DOUGLAS M. STETSON 7 Dec. 1990 15 p

52 AEROSPACE MEDICINE

(AD-A242795; NSMRL-1162) Avail: NTIS HC/MF A03 CSCI 15/6

We evaluated the performance of a computer program designed to assist corpsmen in managing patients who are present at sea with chest pain. The diagnostic accuracy of the program for three common and serious causes of chest pain (myocardial infarction (MI), angina, chest infection) as well as its accuracy for nonspecific chest pain, was compared with that of emergency room physicians at three Naval hospitals for 132 patients. The percentage of correct diagnoses by the computer program (72 pct.) was not significantly different from that of the physicians (79 pct.), although the accuracy of the physicians was better. The computer program was able to distinguish MI from the other diseases as well as the physicians (i.e., was as sensitive, 83 vs. 84 pct.) and at the same time made fewer false diagnoses of MI (i.e., was more specific). The computer's ability to distinguish among cardiac illnesses was not as good as that of the physicians and it misdiagnosed more cases of angina. The computer program is suitable for use by medical personnel practicing in isolated locations and may help improve diagnostic accuracy in cases of MI. Its failures emphasize that it cannot substitute for medical personnel, but can be helpful to medical personnel when a patient's diagnosis is uncertain. GRA

N92-15538* National Aeronautics and Space Administration, Washington, DC.

AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 356)

Dec. 1991 71 p

(NASA-SP-7011(356); NAS 1.21:7011(356)) Avail: NTIS HC A04; NTIS standing order as PB91-912300, \$15.00 domestic, \$30.00 foreign CSCI 06/5

This bibliography lists 192 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during November 1991. Subject coverage includes: aerospace medicine and psychology, life support systems and controlled environments, safety equipment, exobiology and extraterrestrial life, and flight crew behavior and performance.

Author

N92-15868*# Alabama A & M Univ., Huntsville. Food Science and Animal Industries.

BIOLOGICAL PATTERNS: NOVEL INDICATORS FOR PHARMACOLOGICAL ASSAYS

JACQUELINE U. JOHNSON /in Alabama Univ., Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program 3 p. Oct. 1991

(Contract NGT-01-002-099)

Avail: NTIS HC/MF A12 CSCI 06/3

Variable gravity testing using the KC-135 demonstrated clearly that biological pattern formation was definitely shown to result from gravity alone, and not from oxygen gradients in solution. Motile pattern formation of spermatozoa are driven by alternate mechanisms, and apparently not affected by short-term changes in gravity. The chemical effects found appear to be secondary to the primary effect of gravity. Cryopreservation may be the remedy to the problem of 'spare' or 'standing order' biological samples for testing of space lab investigations, but further studies are necessary.

Author

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BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

A92-17421

AIR NAVIGATION TRAINING AT MATHER AIR FORCE BASE - SYNERGISM BETWEEN HUMANS AND MACHINES

KEVIN S. C. DARNELL (USAF, Mather AFB, CA) Navigation (ISSN 0028-1522), vol. 38, Fall 1991, p. 225-234. refs Copyright

Navigation training for the Air Force, Navy, Marine Corps, and many of our allied nations happens at Mather Air Force Base in Sacramento, California. Training before 1975 occurred through classroom instruction and inflight performance. With the purchase of a dedicated computer, navigation training is now a three-element system of classroom academics, computer simulations, and inflight instruction. Each training element enhances the student's ability to make navigational judgments under varying conditions. The Department of Defense continues to adapt to the needs of the military forces. Mather uses slides, tapes, and a computer-aided instruction program to supplement classroom work. Personal computers provide practice on radar and celestial navigation missions. Navigation training moves to Randolph AFB, Texas, in the summer of 1993.

Author

A92-18555* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

HUMAN FACTORS CONSIDERATIONS FOR TRAINING ASTRONAUTS TO FUNCTION EFFECTIVELY IN MULTIPLE ENVIRONMENTS

MALCOLM M. COHEN (NASA, Ames Research Center, Moffett Field, CA) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 6 p. refs

(IAF PAPER 91-560) Copyright

This paper reviews some of the basic issues involved in training individuals to function appropriately under the several conditions that comprise the aerospace environment. The topic of transfer of training is examined in some detail, and the use of high-fidelity simulators in various training programs is discussed. Both current and classical techniques used to train astronauts are noted, and some relatively new and innovative training techniques and methods are described. Particularly, the paper discusses an important aspect of functioning appropriately in a given environment that is based on how well the operator calibrates his motor activity for that specific environment. The role of motor-sensory feedback for the acquisition of motor skills is discussed in the context of training.

Author

A92-19066

ASTRONAUTICS AND PSYCHOLOGY - RECOMMENDATIONS FOR THE PSYCHOLOGICAL TRAINING OF ASTRONAUTS

GERHARD F. HAUPT (Oneness Mentality of the Royal Borough of Kensington and Chelsea, London, England) Acta Astronautica (ISSN 0094-5765), vol. 25, Nov. 1991, p. 733-736. refs

Copyright

The methods presently applied in the psychological training of astronauts are based on the principle of ensuring maximum performance of astronauts during missions. The shortcomings are obvious since those undergoing training provide nothing but the best ability to cope with earth problem situations and add simply an experience of space problem situations as they are presently conceived. Earth attitudes and earth behavior remain and are simply modified. Through the utilization of interdisciplinary space knowledge, a much higher degree of problem anticipation could be achieved and the astronaut be psychologically transformed into a space-being. This would at the same time stimulate interdisciplinary space research. The interdisciplinary space knowledge already available suggests that space requires not only physical and mental adjustments, but a profoundly new relationship with life.

Author

A92-20363

HOW 'THIRD FORCE' PSYCHOLOGY MIGHT VIEW HUMANS IN SPACE

ALBERT A. HARRISON and JOSHUA SUMMIT (California, University, Davis) Space Power - Resources, Manufacturing and Development (ISSN 0883-6272), vol. 10, no. 2, 1991, p. 185-203. refs

Copyright

While avoiding alarmist positions, recent reviews of psychology

and spaceflight have tended to focus on performance decrements, dwindling motivation, emotional instability, social conflict, and other adverse consequences of prolonged spaceflight. Drawing on 'third force' or humanistic psychology, the present paper describes some of the psychological benefits of manned space missions. These include enhanced competence and mastery, self-actualization, heightened imagination, peak experiences (or overview effects), increased ability to deal with stress, high social cohesion, and serving as an inspiration for others. Third force psychology, with its emphasis on human talent and resourcefulness, has clear implications for space mission design. Author

A92-20456

TRAINING FOR INTERNATIONAL SPACE STATION 'FREEDOM' - A NEW PERSPECTIVE

J. MUCCIO (Booz, Allen and Hamilton, Inc., Wassenaar, Netherlands), W. OCKELS (ESTEC, Noordwijk, Netherlands), and E. GIBSON (OHG System GmbH, Bremen, Federal Republic of Germany) ESA Bulletin (ISSN 0376-4265), no. 68, Nov. 1991, p. 85-92.

Copyright

The International Space Station 'Freedom' involves several unique challenges which must be addressed if an effective and affordable training program is to be developed. Compared with past programs, 'Freedom' will be much larger, will involve much longer stays in space for the crew, and will operate more like a ground-based laboratory than a space vehicle. Although they may initially seem insignificant, these three parameters will have a profound impact on both the structure and content of the Space Station training program. Author

N92-14587# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

THE MATCHING OF DOUBLY AMBIGUOUS STEREOGRAMS

DAPHNA WEINSHALL Jul. 1991 23 p

(Contract DACA76-85-C-0010; N00014-85-K-0124)

(AD-A241251; AI-M-1312) Avail: NTIS HC/MF A03 CSCL 12/2

I have previously described psychophysical experiments that involved the perception of many transparent layers, corresponding to multiple matching, in doubly ambiguous random dot stereograms. Additional experiments are described in the first part of this paper. In one experiment, subjects were required to report the density of dots on each transparent layer. In another experiment, the minimal density of dots on each layer, which is required for the subjects to perceive it as a distinct transparent layer, was measured. The difficulties encountered by stereo matching algorithms, when applied to doubly ambiguous stereograms, are also described. Algorithms that can be modified to perform consistently with human perception, and the constraints imposed on their parameters by human perception, are discussed. GRA

N92-14588# Dayton Univ., OH.

TRANSFER OF TRAINING FROM A RADAR INTERCEPT PART-TASK TRAINER TO AN F-16 FLIGHT SIMULATOR Final Technical Report, Mar. 1988 - Mar. 1991

BERNELL J. EDWARDS and DAVID C. HUBBARD Aug. 1991 13 p

(Contract F33615-90-C-0005)

(AD-A241493) Avail: NTIS HC/MF A03 CSCL 05/6

Fifty student pilots participated in an experiment to determine the training effectiveness of an experimental air intercept part-task trainer. F-16 student pilots with no prior knowledge of air intercepts were randomly assigned as subjects either to an experimental group or to a control group. Experimental subjects (n=25) learned to perform air intercept basic skills in the Air Intercept Trainer (AIT), followed by training on intercepts in an F-16 Operational Flight Trainer (OFT). Control group subjects (n=25) received only standard academic training on air intercepts prior to training in the OFT. Instructors, who were not informed of the assignment of subjects to groups during the experiment, rated student performance during OFT training using a 5-point scale (0-4) in five skill categories: (1) radar use, (2) aircraft control, (3) intercept geometry, (4) situational awareness, and (5) overall execution of

intercepts. The number of trial intercepts required by each student to achieve a proficiency rating of 3 (overall execution of intercepts) was recorded. Mean composite ratings of the AIT-trained subjects were found to be higher than those of non-AIT-trained subjects in all five skill categories. These differences were statistically significant for all but the first category (radar use). The percentage of AIT-trained subjects who achieved Level 3 proficiency ratings on basic and advanced intercepts in the OFT was significantly higher than that non-AIT-trained subjects on three out of four types of intercepts. These findings provide evidence that the AIT can improve training of basic intercepts compared to standard syllabus procedures alone. GRA

N92-14589# Dayton Univ., OH.

CONTRACTOR-SUPPORTED AIRCREW TRAINING SYSTEMS: ISSUES AND LESSONS LEARNED Final Report, Jan. 1989 - Feb. 1991

MARTY R. ROCKWAY and ROBERT T. NULLMEYER Aug. 1991 44 p

(Contract F33615-90-C-0005)

(AD-A241590; AL-TR-1991-0031) Avail: NTIS HC/MF A03 CSCL 05/9

The current trend within the Air Force is to design aircrew training programs as total integrated systems rather than as collections of courses or blocks of instruction. This trend has been coupled with a concurrent shift to contracting-out the design, delivery, and support of aircrew training. These changes have introduced a new set of technical and management issues which impact the design, development, evaluation, and operation of aircrew training programs. AL/HRA is conducting research and development to address several of these issues in order to provide principles, procedures, and user-oriented guidelines to support Air Force acquisition and operational training agencies. In this review, data were collected from several Air Force aircrew training system (ATS) programs to identify the major issues and lessons learned during the design, development, evaluation, and operation of these systems. In addition, data were also obtained from selected Navy and allied forces aircrew training systems to serve as a cross-check on the generality of the Air Force findings. The major findings of the ATS review are summarized, and key issues and lessons learned are identified and discussed. GRA

N92-14590# Dayton Univ., OH.

B-52 AND KC-135 MISSION QUALIFICATION AND CONTINUATION TRAINING: A REVIEW AND ANALYSIS Final Report, Apr. 1987 - Apr. 1991

PHILIP D. BRUCE and THOMAS H. KILLION Aug. 1991 38 p

(Contract F33615-87-C-0012)

(AD-A241591; AL-TR-1991-0010) Avail: NTIS HC/MF A03

CSCL 05/9

This report documents the findings of a review and analysis of mission qualification and continuation training for B-52 and KC-135 aircrews. The effort addressed unit perceptions of the capabilities of formal school graduates, training requirements, training resources, aircrew and training system evaluation, and management. In addition to providing extensive descriptive and analytical information about the operation of a large aircrew training system, the report includes as major findings: (1) the need to clarify initial qualification training requirements; (2) evidence of widespread support for recent initiatives regarding training of tactics and warfighting skills, and a corresponding need for increased attention to the design and implementation of this training; (3) the necessity for effective and efficient allocation of training resources across the continuum of training; (4) the need to develop improved methods for evaluating individuals and aircrews--especially in terms of combat skills--and the training system as a whole; and (5) the need for an improved mechanism to manage the training requirements process throughout the training system. Recommendations are provided for research and development in several key areas. GRA

N92-15539# Dartmouth Coll., Hanover, NH. Dept. of Psychology.

MULTIMODAL INTERACTIONS IN SENSORY-MOTOR

PROCESSING Annual Technical Report, Jul. 1990 - Jul. 1991

PATRICIA A. REUTER-LORENZ, H. C. HUGHES, ROBERT FENDRICH, G. NOZAWA, and M. S. GAZZANIGA 30 Aug. 1991 108 p

(Contract AF-AFOSR-0437-89)

(AD-A242511; AFOSR-91-0762TR) Avail: NTIS HC/MF A06 CSCL 06/5

We describe our progress in: (1) delineating the functional architecture of the human saccadic and attentional orienting systems (section 2) based on analyses of reaction times; and (2) development of accurate surface maps of the human neocortex in vivo from reconstructions of MR scans (section 3). Work carried out under AFOSR funding (2 in 90-91 year) provides the basis for our current model, which identifies two serially organized component processes in saccade generation (section 1.1). The early component is sensory; its most noteworthy feature being the mode of convergence of visual and auditory information in the saccadic control system (section 1.2). In the subsequent pre-motor component, the processing time is partially determined by the state of fixation. Fixation point offsets facilitate saccade latencies by decreasing premotor processing times via disinhibition. These sensory and motor facilitatory mechanisms can be combined to optimize human saccadic performance (section 1.1). The ultimate goal is to provide a model which accounts for human oculomotor performance in terms of physiologically plausible component subprocesses. GRA

N92-15540# Air Force Human Resources Lab., Brooks AFB, TX.

THE ANALYTIC ONION: EXAMINING TRAINING ISSUES FROM DIFFERENT LEVELS OF ANALYSIS Interim Paper, Jul. 1989 - Jun. 1991

THEODORE A. LAMB and KERIC B. CHIN Sep. 1991 29 p (Contract AF PROJ. 1121)

(AD-A242523; AL-TP-1991-0033) Avail: NTIS HC/MF A03 CSCL 05/6

The layers found in an average grocery store onion, perhaps of the sweet Vidalia variety, are used as an analog for levels of conceptual analysis. This paper focuses on applying the 'Analytic Onion' to training issues. The core of the analytic onion is the biological level, surrounded by the individual, the group, the organizational, community, societal, world system, and space system levels of analysis. Each level of analysis is discussed in the paper as well as the interactions between the levels. Disciplinary perspectives from biology, psychology, social psychology, political science, and sociology are presented. All of these disciplines are viewed as having contributions to make the examination of training issues when the focus is on the appropriate level of analysis. This paper presents these varied perspectives in unitary fashion and argues that using a single disciplinary perspective may result in missing many alternative training solutions to operational problems or solutions to training and operational problems which do not appear at first glance to be related to training or operations. GRA

N92-15541# Federal Aviation Administration, Cambridge, MA. **ANALYSIS OF PILOT RESPONSE TIME TO TIME-CRITICAL AIR TRAFFIC CONTROL CALLS Final Report, Jul. 1990 - Jun. 1991**

KIM M. CARDOSI and PAMELA W. BOOLE Aug. 1991 19 p (AD-A242527; DOTVNTSC-FAA-91-12; DOT/FAA/RD-91/20) Avail: NTIS HC/MF A03 CSCL 05/9

One of the most important time-critical air traffic control messages for a pilot is one that required an immediate maneuver for traffic avoidance. This study examines the time required for air traffic controllers to successfully transmit such a message in the en route environment as measured from the beginning of the controller's message to the end of the pilot's correct acknowledgement. This total time is broken down into its component parts: the duration of the controller's message, the

time between the end of the controller's message and the beginning of the pilot's response, and the duration of the pilot's acknowledgement. For comparison purposes, transmissions relaying clearances for turns for reasons other than traffic and traffic advisories were also examined. GRA

N92-15542# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA.

EARLY TRAINING STRATEGY DEVELOPMENT FOR INDIVIDUAL AND COLLECTIVE TRAINING Final Report, Oct. 1989 - Aug. 1990

LARRY L. MELIZA and BRUCE W. KNERR Aug. 1991 47 p (AD-A242753; ARI-TR-936) Avail: NTIS HC/MF A03 CSCL 05/6

The training strategy for a new weapon system identifies the training devices required, the tasks each device will be used to train, and the circumstances under which each device will be employed. Consideration of embedded training (i.e., use of operational equipment and training software to provide training) as the first option for new weapon systems forces early development of training strategies. Training development tools, such as the Optimization of Simulation-Based Training System, are available to support development of a training strategy, but an overall model is needed to show how the various tools can be integrated to support strategy development. This report describes a high-level model for early training estimation that incorporates other training development tools. The benefits of this model include integration of individual skills training across duty positions, individual skills training with collective training, collective task training across unit missions, and collective task training across echelons. GRA

N92-15543# Westinghouse Hanford Co., Richland, WA. **SITUATIONAL SIMULATIONS IN INTERACTIVE VIDEO**

L. J. SMITH Jul. 1991 5 p Presented at the Interactive Videodisc in Education and Training, Arlington, VA, 21-23 Aug. 1991

(Contract DE-AC06-87RL-10930)

(DE92-002113; WHC-SA-1290; CONF-9108176-1) Avail: NTIS HC/MF A01

The Westinghouse Hanford Company Advanced Training Technologies section is using situational simulations in several interactive video training courses. Two applications of situational simulations will be discussed. In the first, used in the Hanford General Employee Training course, the student evaluates employee's actions in simulations of possible workplace situations. In the second, used in the Criticality Safety course, students must follow well-defined procedures to complete tasks. Design and incorporation of situational simulations will be discussed. DOE

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

A92-17595*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

EVALUATION OF PERSPECTIVE DISPLAYS ON PILOT SPATIAL AWARENESS IN LOW VISIBILITY CURVED APPROACHES

NANCY S. DORIGHI, STEPHEN R. ELLIS (NASA, Ames Research Center, Moffett Field, CA), and ARTHUR J. GRUNWALD (Technion - Israel Institute of Technology, Haifa) IN: AIAA Computing in Aerospace Conference, 8th, Baltimore, MD, Oct. 21-24, 1991, Technical Papers. Vol. 1. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 153-158. refs (AIAA PAPER 91-3727) Copyright

A series of part-task laboratory experiments are planned to study whether the Tunnel-in-the-Sky perspective display can provide a significant improvement in pilot spatial awareness over conventional flight deck displays. Pilot subjects will fly a series of curved approaches to landing using a computer-generated tunnel overlaid on a terrain database. Subjects' primary task will be to look at (localize) various targets in the simulated environment by rotating the head so that the direction indicated is along the line-of-sight as seen through the windshield. Comparisons will be made with subjects performing the same tasks, but using conventional glass cockpit instrumentation. Author

A92-17646* # Mitre Corp., Houston, TX.

A FAILURE DIAGNOSIS AND RECOVERY PROTOTYPE FOR SPACE STATION FREEDOM

CHRISTOPHER A. MARSH, C. J. GUYSE, DAVID G. HAMMEN, and CHRISTINE M. KELLY (Mitre Corp., Houston, TX) IN: AIAA Computing in Aerospace Conference, 8th, Baltimore, MD, Oct. 21-24, 1991, Technical Papers. Vol. 2. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 586-599. Research supported by Mitre Corp. refs (Contract NAS9-18057) (AIAA PAPER 91-3790) Copyright

NASA is investigating the use of advanced automation to enhance crew productivity for Space Station Freedom in numerous areas, one being failure management. This paper describes a prototype that diagnoses failure sources, assesses the future impacts of those failures on other Freedom entities, and generates courses of action whose intents are to recover from the failure within Freedom's operating conditions. Author

A92-17651#

SPOKEN LANGUAGE APPLICATIONS IN AIR TRAFFIC CONTROL

DEBORAH A. DAHL (Unisys Center for Advanced Information Technology, Paoli, PA) IN: AIAA Computing in Aerospace Conference, 8th, Baltimore, MD, Oct. 21-24, 1991, Technical Papers. Vol. 2. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 654-656. Research supported by DARPA and Unisys Defense Systems, Inc. (Contract N00014-89-C-0171) (AIAA PAPER 91-3797) Copyright

Spoken language understanding has the potential for enhancing the safety of air travel as well as for automating many repetitious tasks in human-computer interaction. This paper describes a prototype system in the area of air traffic control which illustrates one example of such an application. The prototype combines off-the-shelf speech recognition technology with natural language understanding technology. This application is built using the X Windowing System and uses Unix interprocess communication to coordinate interactions between a speech recognizer, a natural language understanding component, and an expert system for identifying inconsistencies in air traffic controller utterances. Author

A92-17652#

INTERFACE STYLES FOR THE INTELLIGENT COCKPIT - FACTORS INFLUENCING AUTOMATION DEFICIT

JAMES A. BALLAS, CONSTANCE L. HEITMEYER, and MANUEL A. PEREZ (U.S. Navy, Naval Research Laboratory, Washington, DC) IN: AIAA Computing in Aerospace Conference, 8th, Baltimore, MD, Oct. 21-24, 1991, Technical Papers. Vol. 2. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 657-667. Research supported by U.S. Navy. refs (AIAA PAPER 91-3799)

The factors that produce automation deficit in the interface design of the modern intelligent cockpit are examined. Results show that there are effects on tracking performance due to adaptive automation and interface style. R.E.P.

A92-17771

THE ARCHITECTURE OF ARTIFICIAL GRAVITY - MATHEMATICAL MUSINGS ON DESIGNING FOR LIFE AND MOTION IN A CENTRIPETALLY ACCELERATED ENVIRONMENT

THEODORE W. HALL (Michigan, University, Ann Arbor) IN: Space manufacturing 8 - Energy and materials from space; Proceedings of the 10th Princeton/AIAA/SSI Conference, Princeton, NJ, May 15-18, 1991. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 177-186. refs Copyright

This paper uses mathematical derivations and computer simulations to examine environmental design for life and motion in artificial gravity. Environmental design may help the inhabitants to adapt by specifically responding to the unearthliness of the gravity. Appropriate architecture forms should be derived not only from static geometric constraints, but also from the apparent dynamic behavior of hanging, falling, and moving objects, particularly with regard to concepts of verticality, horizontality, and modularity. This study reveals involute and catenary curves. If properly incorporated into the architecture, these curves may provide visual and tactile cues to aid the inhabitants in comprehending and adapting to their distorted gravity environment. Author

A92-17773

A CONCEPTUAL DESIGN FOR A MODULAR, HIGH-VOLUME, ARTIFICIAL-GRAVITY CREW COMPARTMENT IN A MANNED MARS SPACECRAFT

HOWARD KLEINBERG (Spar Aerospace, Ltd., Advanced Technology Systems Div., Weston, Canada) IN: Space manufacturing 8 - Energy and materials from space; Proceedings of the 10th Princeton/AIAA/SSI Conference, Princeton, NJ, May 15-18, 1991. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 190-203. Research supported by Spar Aerospace, Ltd. refs Copyright

A concept is proposed for the crew compartment of the manned mission to Mars. Other assumptions regarding the configuration are stated, in order to accommodate those of the Life-Section (LS), as appropriate. Among the concept requirements are large internal volume, artificial-gravity spin capability, crew protection from space radiation, and enough volume to carry and operate a closed ecological life support system (CELSS) to support the crew during a journey to and from Mars that may take a year or more. This design will provide a large internal volume, while still being modular enough to be assembled in LEO. It will house the crew's living and working quarters, the CELSS, and the interface between the LS and the rest of the spacecraft. Author

A92-17786* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.

BIOREGENERATIVE TECHNOLOGIES FOR WASTE PROCESSING AND RESOURCE RECOVERY IN ADVANCED SPACE LIFE SUPPORT SYSTEM

DENNIS CHAMBERLAND (NASA, Kennedy Space Center, Cocoa Beach, FL) IN: Space manufacturing 8 - Energy and materials from space; Proceedings of the 10th Princeton/AIAA/SSI Conference, Princeton, NJ, May 15-18, 1991. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 299-302. refs Copyright

The Controlled Ecological Life Support System (CELSS) for producing oxygen, water, and food in space will require an interactive facility to process and return wastes as resources to the system. This paper examines the bioregenerative technologies for waste processing and resource recovery considered for a CELSS Resource Recovery system. The components of this system consist of a series of biological reactors to treat the liquid and solid material fractions, in which the aerobic and anaerobic reactors are combined in a block called the Combined Reactor Equipment (CORE) block. The CORE block accepts the human wastes, kitchen wastes, inedible refractory plant materials, grey waters from the

CELLS system, and aquaculture solids and processes these materials in either aerobic or anaerobic reactors depending on the desired product and the rates required by the integrated system. I.S.

A92-17787

THE DESIGN AND VISUALIZATION OF A SPACE BIOSPHERE. AL GLOBUS (Computer Sciences Corp., El Segundo, CA) IN: Space manufacturing 8 - Energy and materials from space; Proceedings of the 10th Princeton/AIAA/SSI Conference, Princeton, NJ, May 15-18, 1991. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 303-313. refs

Lewis One is a qualitative space biosphere design. It is intended to house 10,000 residents in a cylinder large enough for a 1g rotating habitat module and construction facilities to reproduce the module. The shielding, exterior, and construction bays are non-rotating. Lewis One is compared to the Bernal Sphere space colony designed in the 1970s. Lewis One is visualized using state-of-the-art computer graphics hardware and software to produce a three-dimensional, animated, lighted, shaded, texture mapped surface model. One may interactively 'fly' outside and inside the structure to examine features of interest. Interactively controlled planar cutaways at any location and/or orientation are available. Visualization provides insight into, and feedback on, the design to drive improvements and communicate design concepts. Author

A92-17788

PROGRESS REPORT ON THE BIOSPHERE 2 PROJECT MARK NELSON (Space Biospheres Ventures, Oracle, AZ) IN: Space manufacturing 8 - Energy and materials from space; Proceedings of the 10th Princeton/AIAA/SSI Conference, Princeton, NJ, May 15-18, 1991. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 314-320. refs Copyright

The Biosphere 2 project which focusses on the development of technologies and integrated testbeds for bioregenerative life support systems is discussed. The Biosphere 2 experiment encompasses a diversity of internal ecosystems including rainforest, savannah, desert, marsh, ocean, and agriculture, making it a valuable laboratory for research on global ecology and a ground-bed testbed. O.G.

A92-17798

IMPACT OF AGRICULTURAL MASS FLOW FLUCTUATIONS ON THE LUNAR BASE ENVIRONMENT

NICKOLAUS E. LEGGETT and JUDITH FIELDER IN: Space manufacturing 8 - Energy and materials from space; Proceedings of the 10th Princeton/AIAA/SSI Conference, Princeton, NJ, May 15-18, 1991. Washington, DC, American Institute of Aeronautics and Astronautics, 1991, p. 392-394. Copyright

Lunar agricultural systems need to be structured and operated so as to minimize the degree of fluctuation in mass flows through the system. Mass flow fluctuations from the recycling systems and growth areas can have severe impacts and consequences for a closed lunar base. The smaller the base, the more severe the impact of even moderate mass flow fluctuations. Author

A92-18541

CHEMOLYTHOTROPHIC HYDROGEN-OXIDIZING BACTERIA AND THEIR POSSIBLE FUNCTIONS IN CLOSED ECOLOGICAL LIFE-SUPPORT SYSTEMS

T. G. VOLOVA, J. G. GITELSON, F. IA. SIDKO, and I. N. TRUBACHEV (AN SSSR, Institut Biofiziki, Krasnoyarsk, USSR) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 10 p. (IAF PAPER 91-539)

Results are presented from experiments in which data on the growth, nutrition physiology, and physiological characteristics of some chemolythotropic hydrogen-oxidizing bacteria (hydrogen bacteria and carboxidotrophic bacteria) were correlated with the growth conditions under which these bacteria were cultivated. Data

and calculations are presented demonstrating the feasibility of using chemolythotrophs as producers of biosynthetic target substances in a closed life support system. In particular, it is shown that, the quality of the proteins of a hydrogen bacteria Th. pyriformis is close to that of casein. I.S.

A92-18556 Massachusetts Inst. of Tech., Cambridge.

HUMAN LOCOMOTION AND WORKLOAD FOR SIMULATED LUNAR AND MARTIAN ENVIRONMENTS

DAVA J. NEWMAN and HAROLD L. ALEXANDER (MIT, Cambridge, MA) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 8 p. refs (Contract NGT-50512)

(IAF PAPER 91-561) Copyright

Human locomotion in simulated lunar and Martian environments is investigated. A unique human-rated underwater treadmill and an adjustable ballasting harness simulate partial gravity in order to better understand how gravity determines the biomechanics and energetics of human locomotion. This study has two research aspects, biomechanics and energetics. The fundamental biomechanics measurements are continuously recorded vertical forces as exerted by subjects on the treadmill which is instrumented with a force platform. Experimental results indicate that peak vertical force and stride frequency decrease as the gravity level is reduced. Foot contact time is independent of gravity level. Oxygen uptake measurements, VO₂, constitute the energetics, or workload, data for this study. As theory predicts, locomotion energy requirements for lunar (1/6-g) and Martian (3/8-g) gravity levels are significantly less than at 1-g. The observed variation in workload with gravity level is nonmonotonic, however, in over half the subject population. The hypothesis is offered that energy expenditure increases for lunar, as compared with Martian, locomotion due to the subject 'wasting energy' for stability and posture control in simulated lunar gravity. Biomechanics data could influence advanced spacesuit design and planetary habitat design, while workload data will help define oxygen requirements for planetary life support systems. Author

A92-18557

HUMAN FACTORS IN THE CONCEPTION OF THE HERMES SPACE VEHICLE

F. WINISDOERFFER (Aerospatiale, Les Mureaux, France) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 11 p. refs

(IAF PAPER 91-562) Copyright

The status of the habitability studies performed during the course of the development of the Hermes Space Vehicle is discussed in terms of functions to be fulfilled. Based on crew role definition and scenario, usage analysis was performed through computer simulations and full-scale testing in 1g and neutral buoyancy conditions to specify and verify the adequacy of the configuration with respect to its use by the crew. Some results of this usage analysis are presented in terms of human-factor engineering, design rules, and requirements that will enable the system and subsystem designers to efficiently take into account the presence of humans on board at an early stage of the definition. P.D.

A92-18559

THE HUMAN FACTOR DURING THE PREPARATION OF A MANNED SPACE FLIGHT

LIONEL SUCHET and DENIS THIERION (CNES, Toulouse, France) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 7 p.

(IAF PAPER 91-565) Copyright

An overview is presented of the human and technical factors involved in the increasingly complex interfaces during the preparations for manned space flights. It is noted that it is necessary to start with the operational aspects as soon as the conception phase begins and it is recommended that association to the classical functional analysis with an operational analysis be made at the same level. R.E.P.

A92-18560**AUTOMATION AND TELEOPERATION IN MANNED SPACEFLIGHT**

E. SCHAFHAUSER, J. R. KASS, and E. GIBSON (OHG System GmbH, Bremen, Federal Republic of Germany) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 7 p.

(Contract ESA-8548/89/NL/IW)

(IAF PAPER 91-567) Copyright

In this paper, a qualitative analysis is made of the various impacts of automation and teleoperations on manned-spacecraft-crew efficiency, facility and experiment development, cost lead-time, and scientific return, with some examples quantitatively analyzed. Teleoperations and ground control of a manned space laboratory carries with it a host of new problems and areas of concern not previously encountered, such as the domain of command and control execution. Conflicts of control and priority, manual override, and procedural guidelines and language, are areas that must be considered from a crew point of view as well as that of the ground operators and experimenters. An attempt is made, in this paper, to view the question of automation and teleoperations not only in the context of technical feasibility, but also with respect to all other relevant impacted factors. Author

A92-18562* Lockheed Missiles and Space Co., Sunnyvale, CA. EVOLUTIONARY DEVELOPMENT OF A LUNAR CELSS

STEVEN H. SCHWARTZKOPF, THOMAS E. STYCZYNSKI (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA), and MARIANN F. BROWN (NASA, Johnson Space Center, Houston, TX) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 9 p. refs

(IAF PAPER 91-572) Copyright

This paper describes a method of evolving the life support technologies of an early lunar base into an advanced life support system. The initial design is a partially-closed regenerative life support system based upon Space Station Freedom physicochemical technology. The paper describes the stepwise evolution of this baseline system into a closed-loop, lunar base Controlled Ecological Life Support System, a hybrid design which incorporates both advanced physicochemical and bioregenerative technologies. Author

A92-18563**USE OF THE EXTERNAL TANK AS AN IN-ORBIT FACILITY FOR CONTROLLED ECOLOGICAL LIFE SUPPORT SYSTEMS RESEARCH**

THOMAS C. TAYLOR, DAVID A. NIXON (Global Outpost, Inc., College Park, MD), CHRISTOPHER JOFEH, MICHAEL W. ISHLER, and JACOB CHAN (Ove Arup and Partners California, Los Angeles) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 8 p. refs

(IAF PAPER 91-573) Copyright

A specific mission concept for the Space Shuttle External Tank converted into a facility for controlled ecological life support (CELS) research is presented. The basic configuration for the research platform is illustrated and the major system hardware elements and the design approach to the internal specimen growth chambers are described. Attention is given to the placement of an external tank in orbit, CELS mission objectives, the inflatable species experiment chamber, and an overview of platform and CELS subsystems. R.E.P.

A92-18565**THE FIRST 'SPACE' VEGETABLES HAVE BEEN GROWN UP IN THE 'SVET' GREENHOUSE BY MEANS OF CONTROLLED ENVIRONMENTAL CONDITIONS**

T. N. IVANOVA (Bulgarian Academy of Sciences, Space Research Institute, Sofia, Bulgaria), I. A. BERKOVICH, A. L. MASHINSKII, and G. I. MELESHKO (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 7 p. refs

(IAF PAPER 91-575) Copyright

The paper describes the project Svet, the creating of a small dimensions space greenhouse of new generation. By means of minicomputer, Svet is full-automatically operating and controlling environmental conditions system in the higher plants growth unit. A number of studies have selected the radish and cabbage vegetables as a potentially important crop for CELSS. The Svet space greenhouse has been mounted on the 'Crystal' technological module docked to the Mir orbital space station on June 10, 1990. The preliminary results of the seeds cultivation for the first 54-day period in Svet are presented. Morphometrical characteristics of the plants, brought back to the earth are given. The vegetation peculiarities, such as the plants growth and the development slow-down, or the dry-substance content increase are noted. For the first time, the root crop of radish plants at microgravity conditions are produced. Characteristics of controlled plants' environment parameters and an estimation of functional properties of control and regulation systems of the Svet greenhouse in space flight are given in terms of telemetry data. Author

A92-18566**CELSS NUTRITION SYSTEM UTILIZING SNAILS**

Y. MIDORIKAWA, T. FUJII (JGC Corp., Tokyo, Japan), A. OHIRA (Institute of Highland Agriculture, Tokyo, Japan), and K. NITTA (National Aerospace Laboratory, Tokyo, Japan) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 7 p. refs

(IAF PAPER 91-576) Copyright

A nutrition system for a lunar base CELSS was described by Midorikawa et al. (1989). A lunar base with a total of eight crew members was envisaged. In the paper, four species of plant, namely rice, soybean, lettuce, and strawberry were introduced to the system. Based on the supply of nutrition from these plants, the fundamental nutritional needs of the crew members could be satisfied. The supply of nutrition from plants and the human nutritional requirements could almost be balanced. The study revealed that the necessary plant cultivation area per crew member occupied nearly 40 square meters in the lunar base. The sources of nutrition considered in the study were energy, sugar, fat, amino acids, inorganic salt, and vitamins; however, calcium, vitamin B2, vitamin A, and sodium were found to be lacking. Therefore, a subsystem to supply these elements is of considerable value. This paper reports on a study for breeding snails and the utilization of the snail meat as food. Nutrients supplied from snails are shown to compensate for the above mentioned lacking elements. The snail breeder and the associated food supply system are evaluated as a subsystem of the CELSS functioning to provide valuable nutrients. Author

A92-18568**SPACECRAFT OPERATIONS - THE HUMAN FACTOR**

DAVID E. B. WILKINS (ESA, European Space Operations Centre, Darmstadt, Federal Republic of Germany) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 9 p. refs

(IAF PAPER 91-580) Copyright

The issues of on-board complexity and human-induced errors are discussed in terms of operational effectiveness by considering human reliability as a system element. The study focuses on incorporating operator error into distinct levels of development including design, integration, testing, and operation. Improved methods of flight control result from the study, but other necessary activities are identified to enhance reliability, error tolerance, and operability. C.C.S.

A92-20210**RANGE, ENERGY, AND HEAT OF MOTION IN AN NBC ANTI-G ANTHROPOMORPHIC TANK SUIT**

JOSEPH A. MASTROPAOLO, ALLEN R. VAN SANTEN (Trisphere Institute of Sports Medicine, Huntington Beach, CA), A. N. DE GASTON, and CRAIG H. DURCK (Douglas Aircraft Co., Long Beach, CA) Journal of Aircraft (ISSN 0021-8669), vol. 28, Dec. 1991, p. 855-860. refs

Copyright

Tests were conducted to ascertain the range of motion, energy expenditure required for movement, heat accumulation, and cardiorespiratory response of the wearer of a nuclear-biological-chemical environment protection-affording, water-lined, anthropomorphic tank suit (ATS). Three human subjects were tested in the ATS with (wet) and without (dry) liner-element water. For steady-state work rates from 48 to 149 W, the dry ATS required a metabolic rate 1.48 times greater than the unclad rate, and the wet ATS figure was 1.73 times greater than unclad. O.C.

A92-20455

AUTOMATION AND ROBOTICS - A FLEXIBLE TECHNOLOGY FOR IN-ORBIT PAYLOAD OPERATIONS

W. DE PEUTER, A. ELFRING (ESTEC, Noordwijk, Netherlands), and M. TOUSSAINT (ESA, Directorate for Space Station and Microgravity, Paris, France) ESA Bulletin (ISSN 0376-4265), no. 68, Nov. 1991, p. 77-82.

Copyright

Several concepts for the automation of system and payload operations in space are examined. Special attention is given to the Automation and Robotics (A&R) technology and to the being developed by the ESA Columbus Programme and the ground-based Columbus Automation and Robotics Testbed (CAT) being developed by the ESA Columbus Programme as a tool for evaluating the benefits of A&R for microgravity experimenter and for familiarizing potential users, payload engineers, and operators with A&R concepts and applications. The CAT will be integrated with the Telescience Testbed, the Crew-Workstation Testbed, and the Data Management System Testbed, allowing very realistic end-to-end simulations of space experimentation scenarios. I.S.

A92-20586 Lockheed Engineering and Sciences Co., Washington, DC.

ANTARCTIC ANALOGS AS A TESTBED FOR REGENERATIVE LIFE SUPPORT TECHNOLOGIES

D. R. ROBERTS, D. T. ANDERSEN (Lockheed Engineering and Sciences Co., Washington, DC), C. P. MCKAY (NASA, Ames Research Center, Moffett Field, CA), R. A. WHARTON, JR. (Nevada, University, Reno), and J. D. RUMMEL (NASA, Life Sciences Div., Washington, DC) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 4 p. refs (IAF PAPER 91-631) Copyright

The feasibility of using Antarctica as a platform for creating earth-based simulations of regenerative life support systems (LSSs) for future space missions is discussed. The requirements for a bioregenerative LSS and the types of technologies that may be used in such a system are examined. Special attention is given to the objectives and the organization of the NASA's CELSS program for the development of regenerative LSSs to support long-duration human missions in space, largely independent of resupply, in a safe and reliable manner. There are two types of locations on the continent of Antarctica suitable for the placement of simulation facilities: the polar plateau and the ice-free dry valleys. The unique attributes that lend each type of location to very different functions as simulation facilities are discussed. I.S.

N92-14591*# Spectra Research Systems, Inc., Huntsville, AL. INITIAL ASSESSMENTS OF LIFE SUPPORT TECHNOLOGY EVOLUTION AND ADVANCED SENSOR REQUIREMENTS, VOLUME 2, APPENDIX A

EDWARD E. MONTGOMERY 3 Sep. 1991 53 p

(Contract NAS8-38781)

(NASA-CR-184248; NAS 1.26:184248;

SRS/STG-TR92-01-VOL-2-APP-A) Avail: NTIS HC/MF A04 CSCL 06/11

The primary issues studied were how the transition from a physical/chemical (P/C) to hybrid to a Closed Ecological Life Support System (CELSS) could be achieved, what sensors and monitors are needed for a P/C-CELSS hybrid system, and how a CELSS could be automated and what controls would be needed to do so. Author

N92-14592*# Spectra Research Systems, Inc., Huntsville, AL.

APPENDICES B THRU F, VOLUME 3

3 Sep. 1991 164 p

(Contract NAS8-38781)

(NASA-CR-184249; NAS 1.26:184249; SRS/STG-TR92-01-VOL-3)

Avail: NTIS HC/MF A08 CSCL 06/11

The purpose of this investigation was to determine if the intermodule ventilation (IMV) systems and water distribution systems of Space Station Freedom (SSF) modules and nodes should be connected as they are interfaced with those already in operation. It was concluded that the AC configuration and attached LAB and HAB modules and nodes should be interconnected. The H2O circuits should also be interconnected. Interconnecting the air and water provides flexibility of operation and safety comparable to the Assembly Complete (AC) configuration. This requires only that valves and ducts be provided in the AC nodes. The AC node interfaces should also be scarred to provide for water transfer across these interfaces. Penalties for not connecting the Intermodular Ventilation (IMV) system and water circuits include an additional AR unit, possible increased water storage requirements, and considerable reduction in crew flexibility. Author

N92-14593*# Spectra Research Systems, Inc., Huntsville, AL.

ADVANCED INSTRUMENTATION: TECHNOLOGY DATABASE ENHANCEMENT, VOLUME 4, APPENDIX G

3 Sep. 1991 225 p

(Contract NAS8-38781)

(NASA-CR-184250; NAS 1.26:184250;

SRS/STG-TR92-01-VOL-4-APP-G) Avail: NTIS HC/MF A10

CSCL 06/11

The purpose of this task was to add to the McDonnell Douglas Space Systems Company's Sensors Database, including providing additional information on the instruments and sensors applicable to physical/chemical Environmental Control and Life Support System (P/C ECLSS) or Closed Ecological Life Support System (CELSS) which were not previously included. The Sensors Database was reviewed in order to determine the types of data required, define the data categories, and develop an understanding of the data record structure. An assessment of the MDSSC Sensors Database identified limitations and problems in the database. Guidelines and solutions were developed to address these limitations and problems in order that the requirements of the task could be fulfilled. Author

N92-14594*# Spectra Research Systems, Inc., Huntsville, AL.

CLEAN ROOM SURVEY AND ASSESSMENT, VOLUME 5, APPENDIX H

3 Sep. 1991 110 p

(Contract NAS8-38781)

(NASA-CR-184251; NAS 1.26:184251;

SRS/STG-TR92-01-VOL-5-APP-H) Avail: NTIS HC/MF A06

CSCL 06/11

The scope of this task is to perform a comparative analysis of the various Environmental Control Life Support System (ECLSS) options for different growth scenarios. The Space Station Freedom ECLSS design and existing ground-based clean room facilities are used as a baseline for comparison. Specifically addressed here are the ground based clean room facilities at the Marshall Space Flight Center (MSFC). Given here is an evaluation of the facilities, equipment, technologies, and procedures used to maintain specified environments in typical aerospace industrial areas. Twenty-five specific clean rooms are evaluated. The objectives were to collect, compare, and catalog data for each specified facility in the areas of engineering and design, construction materials, work stations, contamination control, particulate elimination, entry systems, and instrumentation, and to make recommendations concerning enhancements required to assure an efficient and orderly evolution of MSFC clean room environmental control facilities. Author

N92-14595*# Spectra Research Systems, Inc., Huntsville, AL.

ADVANCED LIFE SUPPORT STUDY Final Report

3 Sep. 1991 46 p

(Contract NAS8-38781)
(NASA-CR-184247; NAS 1.26:184247; SRS/STG-TR92-01)
Avail: NTIS HC/MF A03 CSCL 06/11

Summary reports on each of the eight tasks undertaken by this contract are given. Discussed here is an evaluation of a Closed Ecological Life Support System (CELSS), including modeling and analysis of Physical/Chemical Closed Loop Life Support (P/C CLLS); the Environmental Control and Life Support Systems (ECLSS) evolution - Intermodule Ventilation study; advanced technologies interface requirements relative to ECLSS; an ECLSS resupply analysis; the ECLSS module addition relocation systems engineering analysis; an ECLSS cost/benefit analysis to identify rack-level interface requirements of the alternate technologies evaluated in the ventilation study, with a comparison of these with the rack level interface requirements for the baseline technologies; advanced instrumentation - technology database enhancement; and a clean room survey and assessment of various ECLSS evaluation options for different growth scenarios. Author

N92-14596# Joint FAO/WHO Codex Alimentarius Commission, Rome (Italy).

CODEX GENERAL STANDARD FOR IRRADIATED FOODS AND RECOMMENDED INTERNATIONAL CODE OF PRACTICE FOR THE OPERATION OF RADIATION FACILITIES USED FOR THE TREATMENT OF FOODS

Jun. 1990 22 p
(DE91-632213; AECS/IB-6) Avail: NTIS HC/MF A03

The Food and Agricultural Organization/World Health Organization (FAO/WHO) Codex Alimentarius Commission was established to implement the Joint FAO/WHO Food Standards Program. The purpose of this program is to protect the health of consumers and to ensure fair practices in the food trade. At its 15th session, held in July 1983, the Commission adopted a Codex General Standard for Irradiated Foods and a recommended international code of practice for the operation of radiation facilities used for the treatment of foods. This standard takes into account the recommendations and conclusions of the Joint FAO/IAEA/WHO Expert Committees convened to evaluate all available data concerning the various aspects of food irradiation. This standard refers only to those aspects which relate to the processing of foods by ionizing energy. The standard recognizes that the process of food irradiation has been established as safe for general application to an overall average level of absorbed dose of 10 KGy. The latter value should not be regarded as a toxicological upper limit above which irradiated foods become unsafe; it is simply the level at or below which safety has been established. The standard provides certain mandatory provisions concerning the facilities used and for the control of the process in the irradiation plants. The present standard requires that shipping documents accompanying irradiated foods moving in trade should indicate the fact of irradiation. The labelling of prepackaged irradiated foods intended for direct sale to the consumer is not covered in this standard. DOE

N92-14597# Anacapa Sciences, Inc., Fort Rucker, AL.
HUMAN FACTORS RESEARCH IN AIRCREW PERFORMANCE AND TRAINING: 1990 ANNUAL SUMMARY REPORT Interim Report, Oct. 1989 - Oct. 1990

D. M. MCANULTY Jun. 1991 118 p
(Contract MDA903-87-C-0523; DA PROJ. 2Q1-62785-A-790; DA PROJ. 2Q2-63007-A-792)
(AD-A241134; ASI-690-339-90; ARI-TR-930) Avail: NTIS HC/MF A06 CSCL 23/2

This report presents summary descriptions of the research projects performed by the contractor. Anacapa personnel worked on 21 research projects and one technical advisory service in emerging aviation systems design, manpower and personnel programs, aviator training, and aviation safety research. The report also describes two research projects that were conducted under subcontract to Anacapa Sciences. The summary description for each project and the technical advisory service contains (1) a background section that describes the rationale for the project and specifies the research objectives; (2) a research approach

section that describes the tasks and activities required to meet the project objectives; (3) a work completed section that may include research findings or, in the case of developmental activities, a description of the research products; and (4) a project status section that describes the projections for future research, if any.

GRA

N92-15544# Joint Food and Agriculture Organization - International Atomic Energy Agency, Vienna (Austria).

ANALYTICAL DETECTION METHODS FOR IRRADIATED FOODS

Mar. 1991 172 p
(DE91-625550; IAEA-TECDOC-587) Avail: NTIS HC/MF A08

The present publication is a review of scientific literature on the analytical identification of foods treated with ionizing radiation and the quantitative determination of absorbed dose of radiation. Because of the extremely low level of chemical changes resulting from irradiation or because of the lack of specificity to irradiation of any chemical changes, a few methods of quantitative determination of absorbed dose have shown promise until now. On the other hand, the present review has identified several possible methods, which could be used, following further research and testing, for the identification of irradiated foods. An IAEA Co-ordinated Research Programme on Analytical Detection Methods for Irradiation Treatment of Food ('ADMIT'), established in 1990, is currently investigating many of the methods cited in the present document. DOE

N92-15545# Bolt, Beranek, and Newman, Inc., Cambridge, MA.
INTERFACE DESIGN TOOLS PROJECT Final Report, Jan. 1989 - May 1990

WILLIAM J. SALTER, DAN CERY, BRUCE PAPAIZIAN, and R. B. ROBERTS Aug. 1991 13 p
(Contract F30602-87-D-0093)
(AD-A242581; BBN-7562; RL-TR-91-177) Avail: NTIS HC/MF A03 CSCL 23/2

This report describes an effort to provide tools that assist in the design and development of user interfaces. Human factors knowledge is used to provide an intelligent capability which can be applied to generate interface alternatives and the underlying code for those alternatives. Two gaps evident in available tools for dealing with windows were also addressed: clustering windows and linking windows. Clustering deals with the grouping of multiple windows, and the tools provided facilitate the specification of screen configurations. Linking tools provide mechanisms to specify and enforce functional dependency between windows, so that when what is in one changes, the other windows change in prespecified ways. GRA

N92-15546# Georgia Inst. of Tech., Atlanta. Center for Human-Machine Systems Research.

INTELLIGENT TUTORING FOR DIAGNOSTIC PROBLEM SOLVING IN COMPLEX DYNAMIC SYSTEMS

VIJAY VASANDANI Sep. 1991 391 p
(Contract N00014-87-K-0482)
(AD-A242619; CHMSR-91-4) Avail: NTIS HC/MF A17 CSCL 05/9

Maintenance training for diagnostic problem solving in complex dynamic systems is carried out either on the job or on simulators. When simulators are used for training, their effectiveness can be improved by integrating intelligent tutoring systems (ITS) into the training programs. Research results from ITSs developed for simpler task domains are generally not very useful in complex engineered domains due to lack of appropriate knowledge representation techniques. The focus of our research is the development of a methodology for decomposing, organizing, and representing domain knowledge of complex dynamic systems for building functional computer-based intelligent tutors. Using our knowledge representation methodology, we implemented an ITS on an Apple Macintosh II computer for the marine power plant domain. The ITS is comprised of a simulated power plant, the tutor, and mouse-based direct manipulation graphical interfaces. The ITS was experimentally evaluated using Naval ROTC cadets

as subjects. Performance of the subjects was analyzed using measures such as percentage of premature and correct diagnosis and percentage of relevant and irrelevant diagnostic tests. Results show that a simulator alone is inadequate, whereas a simulator in conjunction with an ITS can help develop efficient troubleshooting skills. GRA

N92-15547# Army Natick Research and Development Command, MA.

TECHNICAL OBJECTIVE DOCUMENT FOR COMBAT CLOTHING, UNIFORMS, AND INTEGRATED PROTECTIVE SYSTEMS Final Report, May 1988 - Nov. 1991

D. ANDERSON and B. FITZGERALD Nov. 1991 37 p
(AD-A242624; NATICK/TR-92/003) Avail: NTIS HC/MF A03 CSCL 15/5

This document provides information on the Army's technical objectives for the Combat Clothing, Uniforms, and Integrated Protective Systems areas to the external community, both government and nongovernment, including academic, scientific, and industrial organizations. Its purpose is to stimulate the participation of such organizations in Army research and development. Areas include: Management Review; Technology Base Investment Strategy; Progress and Accomplishments; Planned Programs; Research, Technology and Development; Major Technical Barriers; and Program Relationships and Interactions. GRA

N92-15548# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

INFLUENCE OF METABOLIC RATE AT 40 C AMBIENT TEMPERATURE ON WORK TOLERANCE TIMES WITH VARYING LEVELS OF CANADIAN FORCES NBC PROTECTIVE CLOTHING

T. M. MCLELLAN Apr. 1991 38 p
(AD-A242773) Avail: NTIS HC/MF A03 CSCL 15/6

The Canadian Forces has a requirement to be prepared to operate in a nuclear, biologically, and/or chemically (NBC) contaminated environment in the event of war. To protect personnel working in this environment from the effects of contaminating agents an individual protective ensemble (IPE) has been developed which consists of a facial mask/respirator, a clothing coverall, overboots and gloves. Depending on the likelihood and severity of the perceived threat, either the coverall alone may be donned or the entire IPE may be donned so that no skin surface and no portion of the usual combat fatigue clothing is exposed to the environment. The components of the IPE are either semi-permeable or impermeable to moisture penetration; thus the ability to evaporate sweat from the skin surface is severely impaired. This study examined the effects of a warm environmental temperature (40 C and 50 pct. relative humidity) and metabolic rate on soldier's work tolerance time (WTT) while wearing various levels of NBC defence protective clothing. Subjects were tested wearing three levels of clothing protection; combat fatigues (Low); fatigues and a semi-permeable NBC overgarment (Med); fatigues and NBC overgarment, gloves, boots and respirator (High). WTT was the time until rectal temperature reached 39.3 C, heart rate reached 95 pct. maximum, dizziness or nausea precluded further exercise, or 5 h had elapsed. GRA

N92-15855*# Alabama Univ., Huntsville. Dept. of Computer Science.

DEVELOPMENT AND APPLICATION OF VIRTUAL REALITY FOR MAN/SYSTEMS INTEGRATION

MARCUS BROWN *In its* Research Reports: 1991 NASA/ASEE Summer Faculty Fellowship Program 5 p Oct. 1991
(Contract NGT-01-008-021)

Avail: NTIS HC/MF A12 CSCL 05/8

While the graphical presentation of computer models signified a quantum leap over presentations limited to text and numbers, it still has the problem of presenting an interface barrier between the human user and the computer model. The user must learn a command language in order to orient themselves in the model. For example, to move left from the current viewpoint of the model, they might be required to type 'LEFT' at a keyboard. This command

is fairly intuitive, but if the viewpoint moves far enough that there are no visual cues overlapping with the first view, the user does not know if the viewpoint has moved inches, feet, or miles to the left, or perhaps remained in the same position, but rotated to the left. Until the user becomes quite familiar with the interface language of the computer model presentation, they will be prone to losing their bearings frequently. Even a highly skilled user will occasionally get lost in the model. A new approach to presenting type type of information is to directly interpret the user's body motions as the input language for determining what view to present. When the user's head turns 45 degrees to the left, the viewpoint should be rotated 45 degrees to the left. Since the head moves through several intermediate angles between the original view and the final one, several intermediate views should be presented, providing the user with a sense of continuity between the original view and the final one. Since the primary way a human physically interacts with their environment should monitor the movements of the user's hands and alter objects in the virtual model in a way consistent with the way an actual object would move when manipulated using the same hand movements. Since this approach to the man-computer interface closely models the same type of interface that humans have with the physical world, this type of interface is often called virtual reality, and the model is referred to as a virtual world. The task of this summer fellowship was to set up a virtual reality system at MSFC and begin applying it to some of the questions which concern scientists and engineers involved in space flight. A brief discussion of this work is presented. Author

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SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

A92-17989

CH₄/NH₃/H₂O SPARK THOLIN - CHEMICAL ANALYSIS AND INTERACTION WITH JOVIAN AQUEOUS CLOUDS

GENE D. MCDONALD, BISHUN N. KHARE, W. R. THOMPSON, and CARL SAGAN (Cornell University, Ithaca, NY) *Icarus* (ISSN 0019-1035), vol. 94, Dec. 1991, p. 354-367. Research supported by Kenneth T. and Eileen L. Norris Foundation. refs Copyright

The organic solid tholin, whose chemistry furnished an ostensible model for the interaction of organic heteropolymers with the deep aqueous clouds of Jupiter, is presently produced by spark discharge in a CH₄-NH₃-H₂O atmosphere and found to resolve in its unhydrolyzed state into four chemically distinct fractions. These four fractions yield distinctly different proportions of amino acids. The concentrations of amino acids from tholin hydrolysis in the lower aqueous clouds of Jupiter is seen as sufficient for the maintenance of small populations of terrestrial microorganisms. O.C.

A92-20044* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

ENDOGENOUS PRODUCTION, EXOGENOUS DELIVERY AND IMPACT-SHOCK SYNTHESIS OF ORGANIC MOLECULES - AN INVENTORY FOR THE ORIGINS OF LIFE

CHRISTOPHER CHYBA (NASA, Ames Research Center, Moffett Field, CA) and CARL SAGAN (Cornell University, Ithaca, NY) *Nature* (ISSN 0028-0836), vol. 355, Jan. 9, 1992, p. 125-132. Research supported by Kenneth T. and Eileen L. Norris Foundation. refs Copyright

The contribution of organic-rich comets, carbonaceous asteroids, and interplanetary dust particles and of impact shock-synthesized organics in the atmosphere to the origin of life on earth is studied and quantitatively compared with the principal non-heavy-bombardment sources of prebiotic organics. The results

suggest that heavy bombardment before 3.5 Gyr ago either produced or delivered quantities of organics comparable to those produced by other energy sources. C.D.

N92-14251* Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.

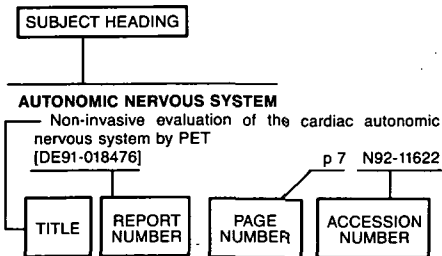
POLYPHASE-DISCRETE FOURIER TRANSFORM SPECTRUM ANALYSIS FOR THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE SKY SURVEY

G. A. ZIMMERMAN and S. GULKIS *In its* The Telecommunications and Data Acquisition Report p 141-154 15 Nov. 1991

Avail: NTIS HC/MF A08 CSCL 06C

The sensitivity of a matched filter-detection system to a finite-duration continuous wave (CW) tone is compared with the sensitivities of a windowed discrete Fourier transform (DFT) system and an ideal bandpass filter-bank system. These comparisons are made in the context of the NASA Search for Extraterrestrial Intelligence (SETI) microwave observing project (MOP) sky survey. A review of the theory of polyphase-DFT filter banks and its relationship to the well-known windowed-DFT process is presented. The polyphase-DFT system approximates the ideal bandpass filter bank by using as few as eight filter taps per polyphase branch. An improvement in sensitivity of approx. 3 dB over a windowed-DFT system can be obtained by using the polyphase-DFT approach. Sidelobe rejection of the polyphase-DFT system is vastly superior to the windowed-DFT system, thereby improving its performance in the presence of radio frequency interference (RFI). Author

Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of document content, a title extension is added, separated from the title by three hyphens. The accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence.

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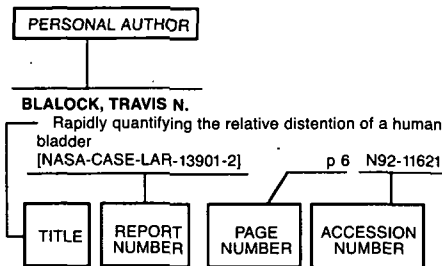
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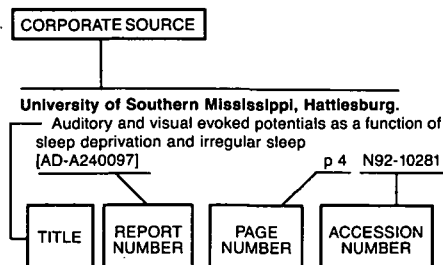
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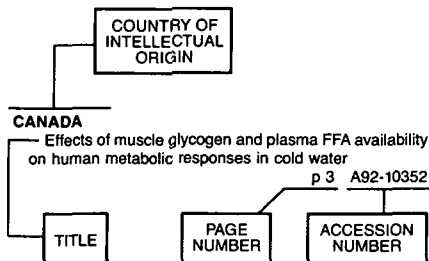
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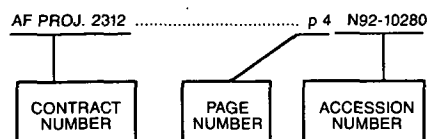
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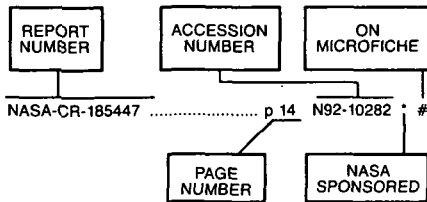
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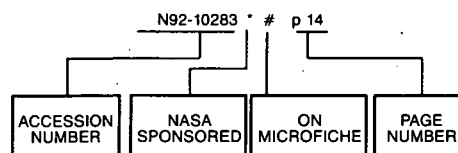


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(916) 322-4572 FAX: (916) 324-8120

COLORADO

UNIV. OF COLORADO - BOULDER

Norlin Library
Govt. Publications
Campus Box 184
Boulder, CO 80309-0184
(303) 492-8834 FAX: (303) 492-2185

DENVER PUBLIC LIBRARY

Govt. Publications Dept. BS/GPD
1357 Broadway
Denver, CO 80203
(303) 571-2135

CONNECTICUT

CONNECTICUT STATE LIBRARY

231 Capitol Avenue
Hartford, CT 06106
(203) 566-4971 FAX: (203) 566-3322

FLORIDA

UNIV. OF FLORIDA LIBRARIES

Documents Dept.
Library West
Gainesville, FL 32611-2048
(904) 392-0366 FAX: (904) 392-7251

GEORGIA

UNIV. OF GEORGIA LIBRARIES

Govt. Documents Dept.
Jackson Street
Athens, GA 30602
(404) 542-8949 FAX: (404) 542-6522

HAWAII

UNIV. OF HAWAII

Hamilton Library
Govt. Documents Collection
2550 The Mall
Honolulu, HI 96822
(808) 948-8230 FAX: (808) 956-5968

IDAHO

UNIV. OF IDAHO LIBRARY

Documents Section
Moscow, ID 83843
(208) 885-6344 FAX: (208) 885-6817

ILLINOIS

ILLINOIS STATE LIBRARY

Reference Dept.
300 South Second
Springfield, IL 62701-1796
(217) 782-7596 FAX: (217) 524-0041

INDIANA

INDIANA STATE LIBRARY

Serials/Documents Section
140 North Senate Avenue
Indianapolis, IN 46204
(317) 232-3678 FAX: (317) 232-3728

IOWA

UNIV. OF IOWA LIBRARIES

Govt. Publications Dept.
Washington & Madison Streets
Iowa City, IA 52242
(319) 335-5926 FAX: (319) 335-5830

KANSAS

UNIV. OF KANSAS

Govt. Documents & Map Library
6001 Malatt Hall
Lawrence, KS 66045-2800
(913) 864-4660 FAX: (913) 864-5380

KENTUCKY

UNIV. OF KENTUCKY LIBRARIES

Govt. Publications/Maps Dept.
Lexington, KY 40506-0039
(606) 257-3139 FAX: (606) 257-1563;
257-8379

LOUISIANA

LOUISIANA STATE UNIV.

Middleton Library
Govt. Documents Dept.
Baton Rouge, LA 70803
(504) 388-2570 FAX: (504) 388-6992

LOUISIANA TECHNICAL UNIV.

Prescott Memorial Library
Govt. Documents Dept.
305 Wisteria Street
Ruston, LA 71270-9985
(318) 257-4962 FAX: (318) 257-2447

MAINE

TRI-STATE DOCUMENTS DEPOSITORY

Raymond H. Fogler Library
Govt. Documents & Microforms Dept.
Univ. of Maine
Orono, ME 04469
(207) 581-1680

MARYLAND

UNIV. OF MARYLAND

Hornbake Library
Govt. Documents/Maps Unit
College Park, MD 20742
(301) 454-3034 FAX: (301) 454-4985

MASSACHUSETTS

BOSTON PUBLIC LIBRARY

Govt. Documents Dept.
666 Boylston Street
Boston, MA 02117
(617) 536-5400 ext. 226
FAX: (617) 267-8273; 267-8248

MICHIGAN

DETROIT PUBLIC LIBRARY

5201 Woodward Avenue
Detroit, MI 48202-4093
(313) 833-1440; 833-1409
FAX: (313) 833-5039

LIBRARY OF MICHIGAN

Govt. Documents Unit
P.O. Box 30007
Lansing, MI 48909
(517) 373-0640 FAX: (517) 373-3381

MINNESOTA

UNIV. OF MINNESOTA

Wilson Library
Govt. Publications Library
309 19th Avenue South
Minneapolis, MN 55455
(612) 624-5073 FAX: (612) 626-9353

MISSISSIPPI

UNIV. OF MISSISSIPPI

J.D. Williams Library
Federal Documents Dept.
106 Old Gym Bldg.
University, MS 38677
(601) 232-5857 FAX: (601) 232-5453

MISSOURI

UNIV. OF MISSOURI - COLUMBIA

Ellis Library
Govt. Documents
Columbia, MO 65201
(314) 882-6733 FAX: (314) 882-8044

MONTANA

UNIV. OF MONTANA

Maureen & Mike Mansfield Library
Documents Div.
Missoula, MT 59812-1195
(406) 243-6700 FAX: (406) 243-2060

NEBRASKA

UNIV. OF NEBRASKA - LINCOLN

D.L. Love Memorial Library
Documents Dept.
Lincoln, NE 68588
(402) 472-2562

NEVADA

UNIV. OF NEVADA

Reno Library
Govt. Publications Dept.
Reno, NV 89557
(702) 784-6579 FAX: (702) 784-1751

NEW JERSEY

NEWARK PUBLIC LIBRARY

U.S. Documents Div.
5 Washington Street -
P.O. Box 630
Newark, NJ 07101-0630
(201) 733-7812 FAX: (201) 733-5648

NEW MEXICO

UNIV. OF NEW MEXICO

General Library
Govt. Publications Dept.
Albuquerque, NM 87131-1466
(505) 277-5441 FAX: (505) 277-6019

NEW MEXICO STATE LIBRARY

325 Don Gaspar Avenue
Santa Fe, NM 87503
(505) 827-3826 FAX: (505) 827-3820

NEW YORK

NEW YORK STATE LIBRARY

Documents/Gift & Exchange Section
Federal Depository Program
Cultural Education Center
Albany, NY 12230
(518) 474-5563 FAX: (518) 474-5786

NORTH CAROLINA

UNIV. OF NORTH CAROLINA -

CHAPEL HILL

CB#3912, Davis Library
BA/SS Dept.—Documents
Chapel Hill, NC 27599
(919) 962-1151 FAX: (919) 962-0484

NORTH DAKOTA

NORTH DAKOTA STATE UNIV. LIBRARY

Documents Office
Fargo, ND 58105
(701) 237-8886 FAX: (701) 237-7138
In cooperation with Univ. of North
Dakota, Chester Fritz Library
Grand Forks

OHIO

STATE LIBRARY OF OHIO

Documents Dept.
65 South Front Street
Columbus, OH 43266
(614) 644-7051 FAX: (614) 752-9178

OKLAHOMA

OKLAHOMA DEPT. OF LIBRARIES

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200 NE 18th Street
Oklahoma City, OK 73105-3298
(405) 521-2502, ext. 252, 253
FAX: (405) 525-7804

OKLAHOMA STATE UNIV.

Edmon Low Library
Documents Dept.
Stillwater, OK 74078
(405) 744-6546 FAX: (405) 744-5183

OREGON

PORTLAND STATE UNIV.

Millar Library
934 SW Harrison - P.O. Box 1151
Portland, OR 97207
(503) 725-3673 FAX: (503) 725-4527

PENNSYLVANIA

STATE LIBRARY OF PENN.

Govt. Publications Section
Walnut St. & Commonwealth Ave.
P.O. Box 1601
Harrisburg, PA 17105
(717) 787-3752

SOUTH CAROLINA

CLEMSON UNIV.

Cooper Library
Public Documents Unit
Clemson, SC 29634-3001
(803) 656-5174 FAX: (803) 656-3025
In cooperation with Univ. of South
Carolina, Thomas Cooper Library,
Columbia

TENNESSEE

MEMPHIS STATE UNIV. LIBRARIES

Govt. Documents
Memphis, TN 38152
(901) 678-2586 FAX: (901) 678-2511

TEXAS

TEXAS STATE LIBRARY

United States Documents
P.O. Box 12927 - 1201 Brazos
Austin, TX 78711
(512) 463-5455 FAX: (512) 463-5436

TEXAS TECH. UNIV. LIBRARY

Documents Dept.
Lubbock, TX 79409
(806) 742-2268 FAX: (806) 742-1920

UTAH

UTAH STATE UNIV.

Merrill Library & Learning Resources
Center, UMC-3000
Documents Dept.
Logan, UT 84322-3000
(801) 750-2684 FAX: (801) 750-2677

VIRGINIA

UNIV. OF VIRGINIA

Alderman Library
Govt. Documents
Charlottesville, VA 22903-2498
(804) 924-3133 FAX: (804) 924-4337

WASHINGTON

WASHINGTON STATE LIBRARY

Document Section
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Olympia, WA 98504-0111
(206) 753-4027 FAX: (206) 753-3546

WEST VIRGINIA

WEST VIRGINIA UNIV. LIBRARY

Govt. Documents Section
P.O. Box 6069
Morgantown, WV 26506
(304) 293-3640

WISCONSIN

ST. HIST. SOC. OF WISCONSIN LIBRARY

Govt. Publications Section
816 State Street
Madison, WI 53706
(608) 262-2781 FAX: (608) 262-4711
In cooperation with Univ. of Wisconsin-
Madison, Memorial Library

MILWAUKEE PUBLIC LIBRARY

Documents Div.
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 278-2167 FAX: (414) 278-2137

WYOMING

WYOMING STATE LIBRARY

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Govt. Publications
Cheyenne, WY 82002
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